



## *Justicia paracambi*, a new Brazilian species of Acanthaceae

DENISE MONTE BRAZ

Departamento de Botânica, Instituto de Biologia, Universidade Federal Rural do Rio de Janeiro, BR-465, km 7, 23890-000, Seropédica, RJ, Brazil

Email: [dmbratz@ufrj.br](mailto:dmbratz@ufrj.br)

### Abstract

*Justicia paracambi* is described as a new, so far strictly endemic species to the state of Rio de Janeiro, which occurs in an area of natural forest in the Parque Natural Municipal do Curió, in the city of Paracambi. It differs from other *Justicia* L. species by the presence of dense glandular and non-glandular trichomes on the rachis, on the bracts and bracteoles and on the calyx, the terminal, lax panicle of spikes with decussate branches and flowers, the calyx 5-lobed, the white to greenish corolla and by the anthers with the lower thecae with a remarkable basal appendage. According to its restricted area of occurrence and the approximate number of individuals, it is considered critically endangered. The new species is described and illustrated and comments on its occurrence, phenology, taxonomy and diagnostic characters are provided.

**Keywords:** Atlantic forest; Rio de Janeiro State; endemism; morphology; taxonomy

### Resumo

*Justicia paracambi* é descrita como uma nova espécie para o Estado do Rio de Janeiro, conhecida até o momento como estritamente endêmica, ocorrendo em uma área de floresta natural no Parque Natural Municipal do Curió, no Município de Paracambi. Difere de outras espécies de *Justicia* L., especialmente, pela presença de tricomas glandulares e não glandulares densos na raque, nas brácteas e bractéolas e no cálice, pela panícula de espigas terminal, laxa e com ramos e flores decussados, pelo cálice 5-lobado, pela corola branca a esverdeada e pelas anteras com a teca inferior com um apêndice basal destacado. De acordo com a sua área restrita de ocorrência e o número aproximado de indivíduos, é considerada criticamente ameaçada. A nova espécie é descrita e ilustrada e comentários sobre a sua ocorrência, fenologia, taxonomia e caracteres diagnósticos são fornecidos.

**Palavras-chave:** Floresta Atlântica; Estado do Rio de Janeiro; endemismo; morfologia; taxonomia

### Introduction

The species described here was collected in relict natural tropical rain forest in the southern Brazilian state of Rio de Janeiro. This area is protected, being part of the *Parque Natural Municipal do Curió* (Municipal Natural Park of Curió), which is mainly occupied by a rich forest with most of it in an excellent state of conservation (Fraga *et al.* 2012, Cysneiros *et al.* 2015). It forms part of a forest continuum between the *Reserva Biológica do Tinguá* (Tinguá Biological Reserve), in the northeast, and the *Parque Estadual Cunhambebe* (Cunhambebe State Park) in the southeast of the State. These forests make up the Serra do Mar Atlantic Forest biodiversity corridor, joining the montane forests of Rio de Janeiro and São Paulo States (Tabarelli *et al.* 2005). Fraga *et al.* (2012) pointed out the importance of Acanthaceae in the understory of the forest in the Curió Park.

The genus *Justicia* L. (Linnaeus 1753: 15) is the most complex and numerous among the Acanthaceae and consists of 600 species distributed throughout the whole world (Ezcurra 2002), with 128 in Brazil (Profice *et al.* 2015), 34 in the Atlantic Forest (Stehmann *et al.* 2009) and 26 in Rio de Janeiro State (Baumgratz *et al.* 2013). McDade *et al.* (2008) have already pointed to the discovery of many new species of the tribe Justiceae Bremekamp (Bremekamp 1965: 29) in the Neotropics, including *Justicia*. In recent times, studying the flora of Bolivia, Wasshausen & Wood (2003) reported no less than 21 new species for this genus; and just for the Semiarid region of the State of Bahia,

Brazil, Côrtes & Rapini (2011) found four new ones. In general, species of *Justicia* are recognized by the bilabiate corolla, with the upper lip slightly bilobed and the lower lip 3-lobed, by the two stamens with unequal, asymmetrical or divergent bithecae anthers and the capsule clavate with sterile base and four seeds attached to the modified hook-shaped funiculum (retinaculum).

## Material and Methods

The *Parque Natural Municipal do Curió* (Curio Municipal Natural Park) (Curio PNM) is located in the municipal district of Paracambi, Rio de Janeiro, around the geographical coordinates 22°34' and 22°36' longitude and 43°42' and 43°41' latitude, covering an area of approximately 900 ha (Fraga *et al.* 2012). The fragment is mostly woody and covered in Atlantic rain forest (Cysneiros *et al.* 2015). The main aim of this park is to protect local rich water resources, as it is permeated by small rivers, streams and contains some seasonal wetlands. The topography is distinctly hilly, with elevations extending from 100 to 690 m, and the climate ranges from mild subtropical to hot and humid tropical, with an average 23.4° C of annual temperature (Fraga *et al.* 2012). During the studies carried out by Fraga and colleagues (2012) from the *Universidade Federal Rural do Rio de Janeiro* (UFRRJ) this new species of *Justicia* was collected near watercourses at low altitude.

Laboratory work was conducted at the Department of Botany, *Instituto de Biologia*/UFRRJ and the botanical material was treated under the usual herbarium techniques for inclusion in the local Herbarium, RBR. Collections in other herbaria in Rio de Janeiro State (RB, GUA, HB) were consulted to check for other occurrences of the taxon. In addition, the author's personal exsiccate images of the family were used, and an expert colleague in Acanthaceae, Dr. Cíntia Kameyama (Herbaria SP, São Paulo Botanical Institute) was consulted.

For the Scanning electron microscopy (SEM), the anthers were removed directly from the dehydrated plants and deposited on metallic support (stub), spreading its contents. We used the SEM of the *Instituto de Biologia*/UFRRJ, Hitachi, Model TM 1000—Tabletop Microscope (increase x10000), which does not require critical point and metallization phases. The SEM has often been the technique used in the study of pollen grains in Acanthaceae, with the pollen grains directly mounted on stubs without any previous treatment.

## Taxonomy

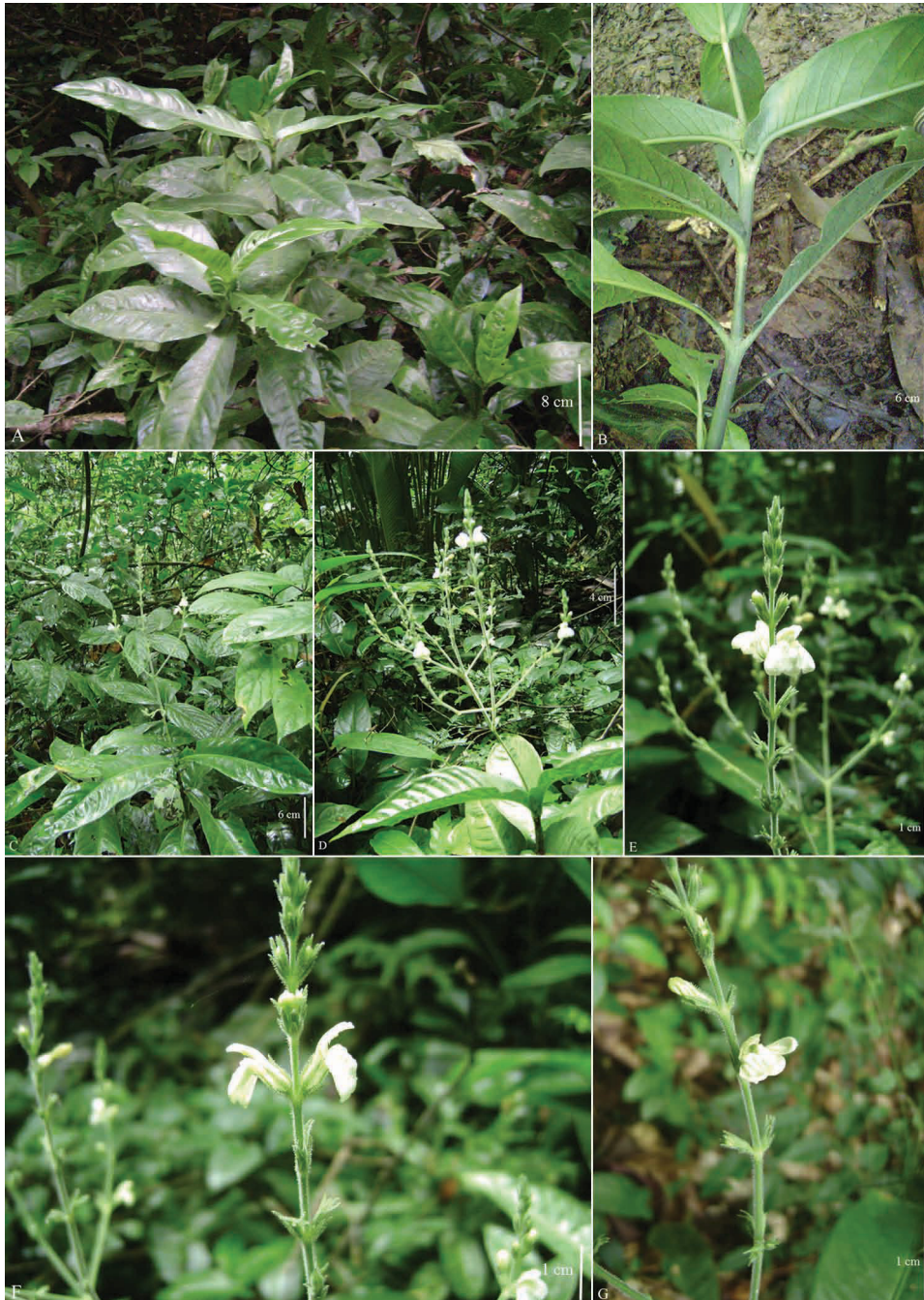
*Justicia paracambi* D.M. Braz, *sp. nov.* (Figs. 1–4)

**Type:**—BRAZIL. Rio de Janeiro: Paracambi, Parque Natural Municipal do Curió. Ocorrendo na bifurcação na trilha à direita. “Erva ca. 70 cm alt., corola bilabiada branca, cálice e brácteas verdes. Inflorescência laxa”, 18 March 2009, Braz, Souza, Marinot & Fraga 157 (holotype RBR!, isotype RB!).

Differs from other species of the genus by the erect herbaceous habit, up to 0.8 m high, glabrous branches and leaves, sessile leaves 15.5–23.6 × 5.3–7.4 cm, the terminal panicle of decussate spikes and flowers, these lax, the bracts 4.1–4.4 × 0.7–1.0 mm, the calyx 5-lobed and covered with simple and glandular trichomes, the white to greenish corolla, 7–9.1 mm long, the anthers with theca almost at right angles and superposed, the lower thecae with a basal appendage, and the seeds borderless, slightly compressed and tuberculate.

Herb 50–80 cm high, stem glabrous, cylindrical at base, compressed toward apex, cystoliths prominent. Leaves sessile, blade 15.5–23.6 × 5.3–7.4 cm, elliptic, apex acute, base cuneate, slightly auriculate, glabrous on both surfaces, cystoliths dense, especially in the middle vein on the lower surface, secondary veins brochidodromous, 16–17 pairs. Inflorescence a terminal panicle of decussate spikes, lax, 12.9–29 cm long, flowers decussate, peduncle 63–92 mm long; bracts and bracteoles green, subulate, subciliate, bracts 4.1–4.4 × 0.7–1.0 mm; bracteoles 3.3–4.0 × 0.5–0.6 mm; rachis, bracts and bracteoles densely covered in glandular and non-glandular trichomes. Flowers sessile or pedicel up to 2.6 mm long; calyx green, 5-lobed to near the base, 4.6–6.1 × 0.5–0.8 mm, lobes subulate, with scattered glandular and non-glandular trichomes, sometimes ciliate; corolla bilabiate, white, sometimes slightly green at throat, 7–9.1 mm long, glabrous, upper lip triangular, 4–4.8 mm long, 2.9–3.5 mm wide. at base, the 2 lobes ca. 2 mm long, lower lip with 3 lobes oblong, truncate at apex, 2.8–3.3 × 1.9–2.3 mm; filaments 3.1–4.2 mm long, inserted 2.8–4.3 mm above the corolla base, glabrous, anthers 0.8–1.1 × 0.3–0.5 mm, glabrous, but with a line of whitish trichomes abaxially, the two thecae somewhat separated by the expanded connective, superposed, subdivergent, upper thecae almost perpendicular,

slightly asymmetric, lower thecae appendiculate at base, appendage 3-lobed, 0.6–0.8 mm long, whitish, swollen; pollen 2-colporate, prolate,  $21\text{--}28 \times 15\text{--}20 \mu\text{m}$ , 2 narrow ribs associated with each aperture, not joining the others at the poles, exine reticulate; nectariferous disk expanded, 0.3–0.5 mm tall, ovary subcylindrical, 1.5–2.5 mm long., 0.6–0.8 mm diam., glabrous, style ca. 5.1 mm long, base with scattered glandulous trichomes. Capsule subclavate to subfusiform, 8.2–11.8 mm long, 1.1–1.7 mm diam., densely glandular pilose, seeds lenticular,  $1.7\text{--}1.9 \times 0.8\text{--}1 \text{ mm}$ , tuberculate over entire surface.



**FIGURE 1.** *Justicia paracambi* in the Parque Natural Municipal do Curió (Curió Municipal Natural Park), Paracambi, RJ, Brazil: a) Sterile individuals; b) Stem and leaves; c) Flowering plant; d) Terminal inflorescence showing decussate spikes and flowers; e) Inflorescence with decussate flowers; f) Flowers in lateral view; g) Flower in frontal view.

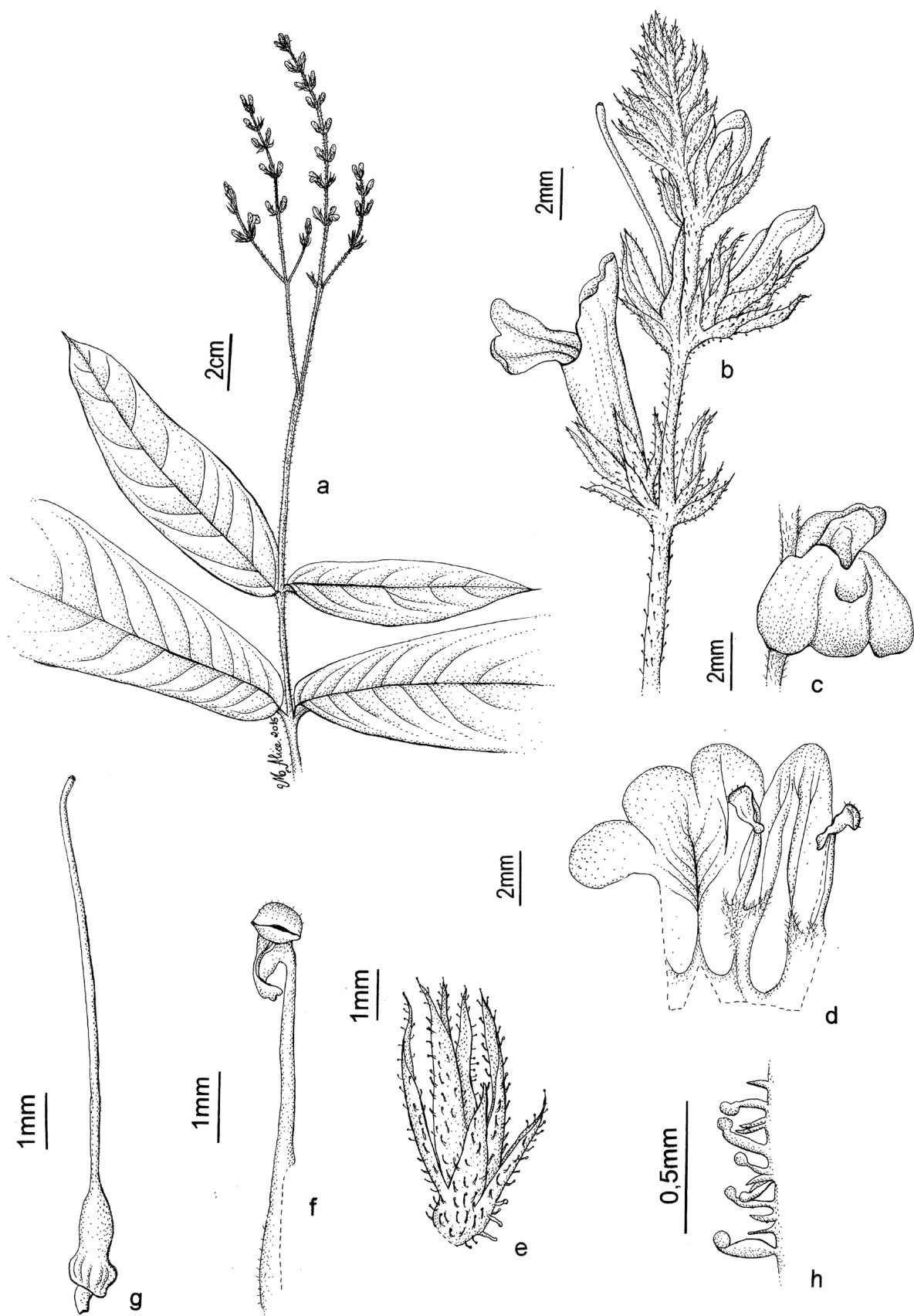
**Additional specimens examined (paratypes):**—BRAZIL. Paracambi, RJ, Parque Natural Municipal do Curió, 2008, *Braz 166* (RBR). *ib.*, 4 September 2009, *Braz 275*, Souza & Moraes (RBR). *ib.*, 22 November 2010 (fl/fr), *Braz 337* & Souza (RBR). *ib.*, 1 April 2011 (fl/fr), *Braz 363* & Souza (RBR).



**FIGURE 2.** *Justicia paracambi*: a) Cystoliths in the stem; b) Cystoliths in the middle vein of the upper leaf surface; c) Bract, bracteoles, calyx and glabrous corolla; d) Rachis, bracts, bracteoles and calyx with dense glandular and non-glandular trichomes; e) A pair of the bithecae anthers; f) The basal appendage of the anthers in detail; g) Seed with tuberculate surface.

**Distribution and habit:**—The new species is so far known only from the type locality, the *Parque Natural Municipal do Curió*, Municipality of Paracambi, in the southern part of Rio de Janeiro State, Brazil. It grows in dense forest and especially near watercourses at low altitudes.

**Phenology:**—It flowers and fruits almost all year, but especially between September and November.



**FIGURE 3.** *Justicia paracambi*: a) Flowering stem; b) Inflorescence with buds and one open flower; c) Bract, bracteole and calyx; d) Corolla, frontal view; e) Open corolla with the epipetalous stamens; f) Stamen; g) Gynoeceium; h) Glandular and non-glandular trichomes on the rachis. Drawn from Braz 166 (RBR).

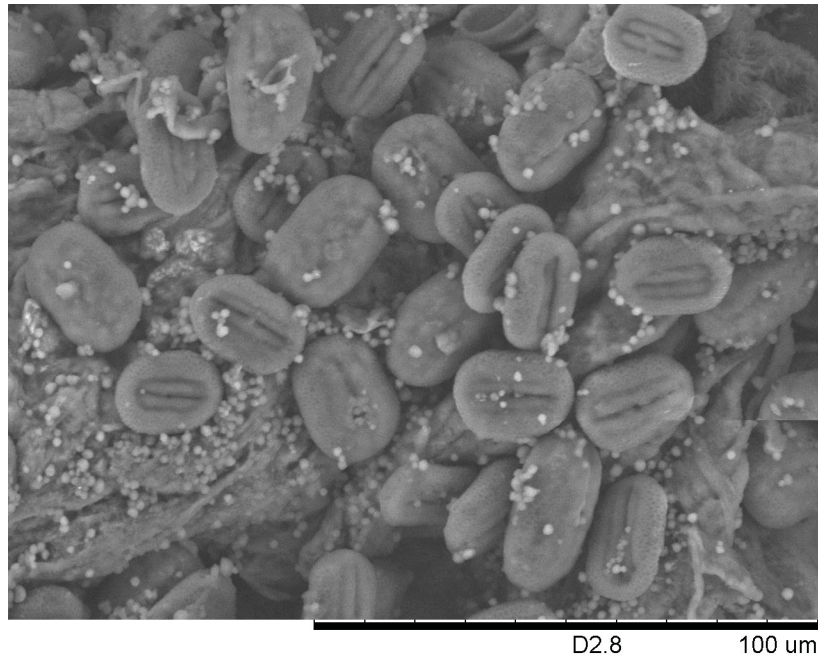


FIGURE 4. *Justicia paracambi*: pollen grains using scanning electron microscopy.

### Discussion and affinities

*Justicia paracambi* can be easily recognized by the glabrous, sessile leaves, the lax terminal inflorescence, with spikes and flowers decussate, the rachis, bracts, bracteoles and calyx with dense glandular-hirsute trichomes, the greenish-white corolla and the lower theca with a long basal appendage. Other species with some similarity and possible co-occurrence are *J. tijucensis* V.A.W.Graham and *J. genuflexa* Nees & Mart. The first occurs in the neighboring states of Rio de Janeiro and Espírito Santo, and the second further north, in the states of Espírito Santo and Bahia; they differ from *J. paracambi* by their smaller habit and leaves, as well as the muticous anthers in *J. tijucensis* and the simple inflorescence with 2–3 flowered cymes at its base in *J. genuflexa*.

According to the classification of Graham (1988), *Justicia paracambi* belongs morphologically to section *Sarotheca* (Nees) Benth. in Bentham & Hooker (1876: 1110) because of its compound inflorescence, formed by units of spikes, its glandular axis, the subulate green bracts, the white corolla, the anthers with thecae almost at right angles, the lower one with a basal appendage, and the seeds borderless, slightly compressed and tuberculate. Ezcurra (2002), considered species of this section to have a floral morphology typical of mellitophilous plants with a small white corolla and nectar guides usually maroon or purplish in colour. Although in *J. paracambi* the guides are greenish coloured, we observed numerous visits by bees to its flowers during fieldwork. Graham (1988) mentions that the basal appendage in the lower thecae is usually whitish and may be as long as the theca itself, as is the case in the new species. This structure, which is also swollen in *J. paracambi*, is being investigated in more detail.

Although pollen grains in Acanthaceae are mostly tricolporate, grains with two pores are recorded in other *Justicia* species (Graham 1988, Scotland & Vollesen 2000, Wasshausen & Wood 2003). With respect to the ribs, that do not meet at the poles (*Rahmenpollen*), these are found in other species of the genus (Graham 1988, Wasshausen & Wood 2003) and in other genera of the tribe Justicieae (Scotland & Vollesen 2000). The 2-colporate pollen grains with 4 rows are also consistent with the section *Sarotheca*, although the exine and the insular areas should be better investigated.

*J. paracambi* is considered Critically Endangered based on its area of occurrence in a single locality of less than 10 km<sup>2</sup>; by the inferred continuing decline of its extent of occurrence and habitat quality; and, by the estimated size of the population with less than 50 mature individuals (CR B2ab(i,iii); D) (IUCN 2001). Efforts and immediate action to maintain and expand the area of the *Parque Natural Municipal do Curió*, and all the remaining forests at the Serra do Mar Atlantic Forest biodiversity corridor should be urgent goals for the various public organizations, since they are essential for the preservation of local native endemics, endangered and rare species, as well as the Atlantic Forest as a whole.

## Acknowledgements

Thanks are due to Dr. Alexandre F.B. Araújo for critically reviewing the manuscript; Igor Henrique F. Azevedo, Affonso Henrique N. Souza and Rachel Louise S. Arruda for helping in field work; *Secretaria do Meio Ambiente e Desenvolvimento Sustentável* of Paracambi City, especially to José Luiz de Oliveira and Adriane Salles, for their support in the Park activities; Cíntia Kameyama and Tarciso Filgueiras for help in choosing the name; Dr. Gerson Araújo and José Antônio de Oliveira for their assistance in microscope use; Maria Alice Rezende for the line drawing; and two anonymous reviewers who greatly improved the manuscript.

## References

- Baumgratz, J.F.A., Coelho, M.A.N., Peixoto, A.L., Mynssen, C.M., Bediaga, B.E.H., Costa, D.P., Dalcin, E., Guimarães, E.F., Martinell, G., Silva, D.S.P., Sylvestre, L.S., Freitas, M.F., Morim, M.P. & Forzza, R.C. (2013) *Catálogo das Espécies de Plantas Vasculares e Briófitas do Estado do Rio de Janeiro*. Instituto de Pesquisas Jardim Botânico do Rio de Janeiro. Available from: <http://florariojaneiro.jbrj.gov.br/> (accessed 12 December 2014)
- Bentham, G. & Hooker, J.D. (1876) *Genera Plantarum ad exemplaria imprimis in herbariis Kewensibus 2*. Reeve & Co., Williams & Norgate, London, 1279 pp.
- Bremekamp, C.E.B. (1965) Delimitation and subdivision of the Acanthaceae. *Bulletin of the Botanical Survey of India* 7: 21–30.
- Côrtes, A.L.A. & Rapini, A. (2011) Four new species of *Justicia* (Acanthaceae) from the Caatinga biome of Bahia, Brazil. *Kew Bulletin* 66 (3): 453–461.  
<http://dx.doi.org/10.1007/s12225-011-9295-7>
- Cysneiros, V.C., Oliveira Junior, J.M., Gai, T.D. & Braz, D.M. (2015) Diversity, community structure and conservation status of an Atlantic Forest fragment in Rio de Janeiro State, Brazil. *Biota Neotropica* 15 (2): 1–15.  
<http://dx.doi.org/10.1590/1676-060320150132>
- Ezcurra, C. (2002) El género *Justicia* (Acanthaceae) en Sudamérica Austral. *Annals of the Missouri Botanical Garden* 89: 225–280.  
<http://dx.doi.org/10.2307/3298565>
- Fraga, M.E., Braz, D.M., Rocha, J.F., Pereira, M.G. & Figueiredo, D.V. (2012) Interação microrganismo, solo e flora como condutores de biodiversidade na Mata Atlântica. *Acta botânica brasileira* 26: 857–865.  
<http://dx.doi.org/10.1590/S0102-33062012000400015>
- Graham, V.A.W. (1988) Delimitation and infra-generic classification of *Justicia* (Acanthaceae). *Kew Bulletin* 43: 551–624.  
<http://dx.doi.org/10.2307/4129957>
- IUCN (2001) *IUCN Red List Categories: version 3.1*. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK. Available from: <http://www.iucnredlist.org/technical-documents/categories-and-criteria> (accessed 8 February 2015)
- Linnaeus, C. (1753) *Species Plantarum* 1. Impensis Laurentii Salvii, Stockholm, 560 pp.
- McDade, L.A., Daniel, T.F. & Kiel, C.A. (2008) Toward a comprehensive understanding of phylogenetic relationships among lineages of Acanthaceae s.l. (Lamiales). *American Journal of Botany* 95 (9): 1136–1152.  
<http://dx.doi.org/10.3732/ajb.0800096>
- Proffice, S.R., Kameyama, C., Côrtes, A.L.A., Braz, D.M., Indriunas, A., Vilar, T., Pessoa, C., Ezcurra, C. & Wasshausen, D. (2015) *Acanthaceae* in *Lista de Espécies da Flora do Brasil*. Jardim Botânico do Rio de Janeiro. Available from: <http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB4137> (accessed 30 January 2015)
- Scotland, R.W. & Vollensen, K. (2000) Classification of Acanthaceae. *Kew Bulletin* 55: 513–589.  
<http://dx.doi.org/10.2307/4118776>
- Stehmann, J.R., Forzza, R.C., Salino, A., Sobral, M., Costa, D.P.E. & Kamino, L.H.Y. (Eds.) (2009) *Plantas da Floresta Atlântica*. Instituto de Pesquisa Jardim Botânico do Rio de Janeiro, Rio de Janeiro, 516 pp.
- Tabarelli, M., Pinto, L.P., Silva, J.M.C., Hirota, M.M. & Bedê, L.C. (2005) Desafios e oportunidades para a conservação da biodiversidade na Mata Atlântica brasileira. *Megadiversidade* 1: 132–138.
- Wasshausen, D.C. & Wood, J.R.I. (2003) Notes on the genus *Justicia* in Bolivia. *Kew Bulletin* 58: 769–831.  
<http://dx.doi.org/10.2307/4111199>