

**A cegueira botânica nas vias de escalada de Unidades de Conservação
da Cidade do Rio de Janeiro**

Plant blindness on climbing trails in Rio de Janeiro City Conservation Units

**Ceguera botánica en las rutas de escalada de las Unidades de Conservación
de la Ciudad de Río de Janeiro**

Recebido: 21/11/2019 | Revisado: 23/11/2019 | Aceito: 28/11/2019 | Publicado: 02/12/2019

André Micaldas Corrêa

<https://orcid.org/0000-0002-1394-4938>

Instituto Oswaldo Cruz, Brasil

E-mail: andremicaldas@hotmail.com

Wayler Muñoz Piñeiro Neto

ORCID: <https://orcid.org/0000-0003-3655-3160>

Universidade Veiga de Almeida, Brasil

E-mail: wailer_vo@hotmail.com

Luiz Anastácio Alves

ORCID: <https://orcid.org/0000-0001-6723-9399>

Instituto Oswaldo Cruz, Brasil

E-mail: alveslaa@ioc.fiocruz.br

Resumo

A cidade do Rio de Janeiro apresenta diversos afloramentos rochosos, considerados locais de escalada, que apresentam uma flora característica, complexa e sensível. O presente estudo teve como objetivo pesquisar a flora e o conhecimento de alpinistas sobre essa vegetação em três Unidades de Conservação dessa cidade. Um total de 44 espécies de 19 famílias botânicas foram identificadas pelo nosso grupo nas trilhas de escalada e trilha. Como os escaladores são usuários importantes dessas rotas, 60 responderam a questionários para identificar a possível presença de cegueira botânica. Mais de 90% dos escaladores entrevistados entenderam a importância das áreas protegidas e observaram as plantas ao redor das trilhas, mas não conseguiram identificar a maioria das espécies. Portanto, a cegueira das plantas foi identificada, apesar do respeito dos alpinistas pela natureza. Além disso, foram observadas lacunas em relação ao conteúdo do curso de escalada em Botânica e Meio Ambiente nas áreas protegidas avaliadas.

Palavras-chave: Inselbergs; Escalada; Unidades de Conservação; Cegueira Botânica; Rio de Janeiro.

Abstract

The city of Rio de Janeiro presents several rocky outcrops, considered climbing sites, but presenting a characteristic, complex and sensitive flora. The present study aimed to survey flora and climber knowledge concerning the local vegetation in three Conservation Units in the city. A total of 44 species from 19 botanical families were identified by our group in climbing and track trails. As climbers are important users of these routes, 60 responded questionnaires to identify the possible presence of botanical blindness. Over 90% of the interviewed climbers understood the importance of conservation units and see the plants surrounding the trails, but were unable to identify most species. Therefore, plant blindness was identified, despite climber respect for nature. In addition, gaps were noted concerning climbing course contents on Botany and Environment in the assessed protected areas.

Keywords: Inselbergs; Climbing; Conservation Units; Plant Blindness; Rio de Janeiro.

Resumen

La ciudad de Río de Janeiro tiene varios afloramientos rocosos, considerados lugares de escalada, que tienen una flora característica, compleja y sensible. Este estudio tuvo como objetivo investigar la flora y el conocimiento de los escaladores sobre esta vegetación en tres Unidades de Conservación de esta ciudad. Nuestro grupo identificó un total de 44 especies de 19 familias botánicas en los senderos de escaladas. Como los escaladores son usuarios importantes de estas rutas, 60 respondieron cuestionarios para identificar la posible presencia de ceguera botánica. Más del 90% de los escaladores entrevistados entendieron la importancia de las unidades de conservación y observaron las plantas alrededor de los senderos, pero no pudieron identificar la mayoría de las especies. Por lo tanto, se ha identificado la ceguera de las plantas a pesar del respeto de los escaladores por la naturaleza. Además, se observaron lagunas en relación con el contenido del curso de escalada Botánica y Medio Ambiente en las áreas protegidas evaluadas.

Palabras clave: Inselbergs; Escalada; Unidades de Conservación; Ceguera Botánica; Río de Janeiro.

1. Introdução

The city of Rio de Janeiro presents a series of rocky outcrops known as inselbergs, formed by a granite or gneiss rocky matrix from the pre-Cambrian period, originating over 50 million years ago, which can occur in isolation in the landscape or associated to mountain ranges (Porembski, 2007). Rio de Janeiro contains several inselbergs ranging between 150 and 1000 m in altitude (Saddi, 2008).

These outcrops are repeated along the Brazilian coast, following a north-south direction from Rio Grande do Sul to the Northeast, constituting a unique ecosystem with many endemic species generally associated with the Atlantic Rainforest (Meirelles et al. 1999). Therefore, opportunities for assessments concerning native rupicolous vegetation are noted, given the formation of growth sites in highly specialized regions, with a micro climate that differs from other surrounding areas (Porembski, *op. cit.*).

In this context, South America is home to an immense variety of vegetation, from bromeliads to orchid rupicolous plants (Dressler, 1981), and this ruptured ecosystem associated with the Atlantic Rainforest requires extensive study and understanding in order to contribute scientifically to the conservation of endemic species (Martinelli, 2008; Saddi 2008).

The structural organization of vegetation in inselbergs can be quite complex, due to the lack of homogeneous and/or representative areas. Changes in species composition as a function of microclimate heterogeneity occurs in very small spaces, generating a wide variety of habitat types (Ribeiro et al. 2002).

Inselbergs pose a challenge to the climbing and mountaineering community, both for Rio de Janeiro residents and foreigners. The practice of this sport at the Sugar Loaf Natural Monument (MONA) and the Tijuca massif (Daflon, 2012) has been established since the beginning of the twentieth century, rediscovering these areas in a new perspective, as sites considered inaccessible were discovered and explored in a different way.

Mountaineering and climbing practices established by a growing and historical reoccupation and exploration process have been favored by the reforestation of the Tijuca National Park and Sugar Loaf Natural Monument (Daflon, 2012), as well a neighboring park near Sugar Loaf, the Carioca Landscape. In this scenario, integration between the scientific community, mountain sports communities and associations and region sympathizers and tourists is required, including surveys informative to all climbers and conservation management actors.

In this context, the present study was carried out to identify and analyze climber knowledge concerning botanical species most commonly found in several climbing and track

routes in Rio de Janeiro. The aim was to identify whether climbers they suffer from plant blindness, a concept created to draw attention to the lack of perception, observation and knowledge about local flora which are considered mostly just part of the landscape, sometimes even less (Wandersee; Schussler, 2001).

2. Metodologia

2.1. Study Areas

The Tijuca National Park, a fully protected conservation unit open to the public, was created in 1961, and is located in an area covering a considerable part of the city of Rio de Janeiro. The park comprises about 3,953 ha (Figure 1) of the Atlantic Rainforest ecosystem, largely the result of a reforestation action carried out in the region, which previously consisted mostly of coffee monocultures (Fernandez, 2011). Several rocky outcrops can be approached in this area, such as Pedra da Gávea, Pico da Tijuca and Morro do Corcovado, according figure 1 below

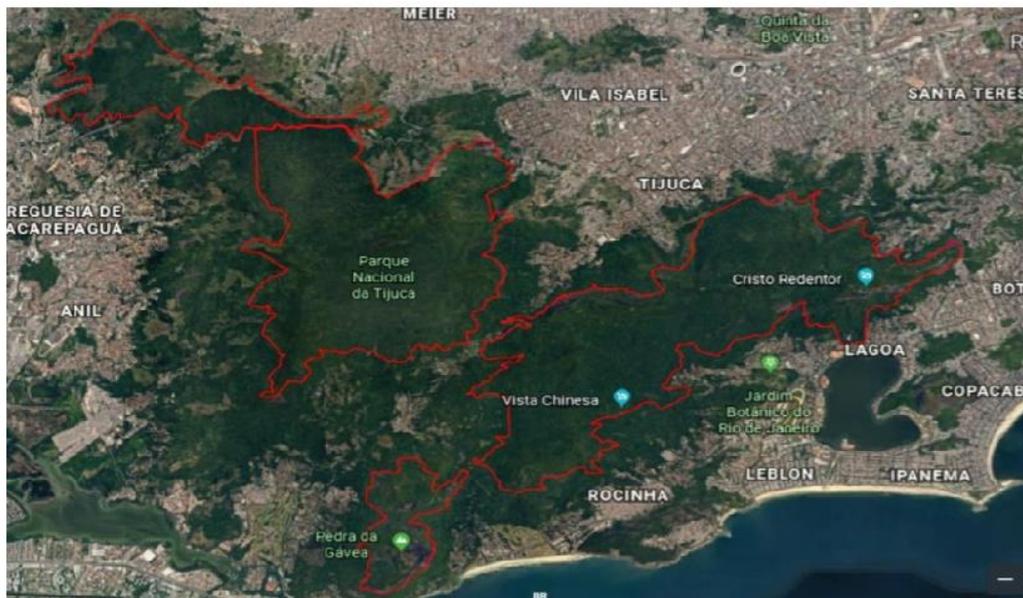


Figure 1 – Tijuca National Park *Sectorization and boundaries*
<http://www.icmbio.gov.br/portal/component/content/article?id=2198:parna-da-tijuca>

The Sugar Loaf Natural Monument was created in June 2006 and comprises the Sugar Loaf and Urca hills areas (Figure 2 next page), located within a fragment of the surrounding Atlantic Rainforest. Several endemic bromeliads are found in the area. This is the first

climbing and tracking route area in the country, dating from 1910, but has been increasingly suffering from high anthropogenic impacts. Therefore, better management actions and research to revitalize this degraded site are required.

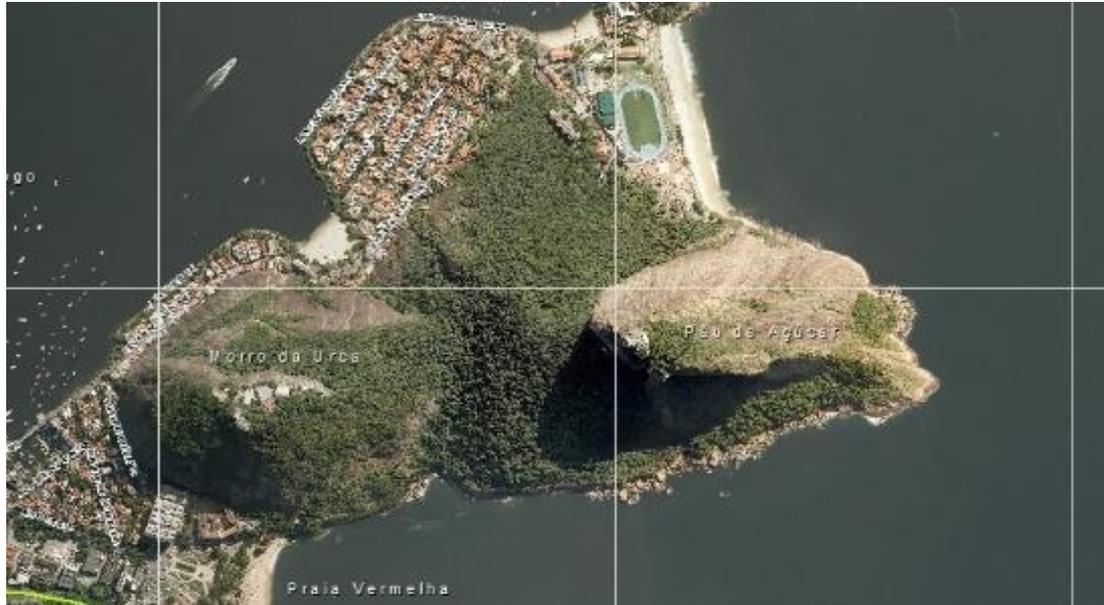


Figure 2. Sugar Loaf Natural Monument (source: Prefeitura da Cidade do Rio de Janeiro <http://www.rio.rj.gov.br/web/smac/exibeconteudo?id=4461307>)

The Municipal Landscape Carioca Natural Park was established in 2013 by a municipal decree, comprising 159.3 ha (Figure 3 below) composed of the São João, Babilônia, Pedra do Leme and Cotunduba Island hills. It is a Conservation Unit that integrates several nearby Environmental Protection Areas. This integration facilitates park administration, and many climbing routes are widely visited by tourists in this area. However, significant impacts are observed, mainly due to excess road establishment on the slope of the north face at the Morro da Babilônia hill (Daflon, 2010).



Figure 3. Map of the integrated Municipal Landscape Carioca Park area (Source: <http://www.rio.rj.gov.br/web/smac/exibeconteudo?id=4263870>).

2.2. Survey

This study was registered at the Plataforma Brasil system and received the approval of the Research Veiga de Almeida University Ethics Committee, number 3,587,301.

Seven climbing routes were selected located on different rocky outcrops inserted at the three assessed Conservation Units, namely Sugar Loaf (MONA Sugar Loaf), Morro da Babilônia (Carioca Landscape Park), and the Tijuca National Park (Pico da Tijuca, Pedra da Gávea and Corcovado).

The chosen trails were: Joker (Coringa), Italians and Costão (in the Sugar Loaf), Paredão Paraíso Perdido (P3 in the Pico da Tijuca), Second Sun (Segundo Sol in the Pedra da Gávea), K2 (in the Corcovado) and Maurício Motta (M2 in the Morro da Babilônia). These routes are the most visited by both Rio de Janeiro resident climbers (“cariocas”) and foreign climbers. A photographic sampling of the local species was performed, by recording aerial parts (leaves, flowers and fruits) of several for identification, in order to understand the local plant biodiversity and what climbers would be able to visualize and possibly identify. Botanical samplings were carried out only when necessary, when in doubt of species identification, and only in the Rio de Janeiro City Hall tutelage area under authorization 15/2019.

Photograph validation was performed by submitting the photos of the collected specimens to Rio de Janeiro Botanical Garden specialists, avoiding further unnecessary sampling, thus preserving the investigated flora. Exsiccates located in the Rio de Janeiro Botanical Garden herbarium were also consulted. Many species can be identified quite safely, by photographs (Barroso, 2002), especially if leaves, flowers and fruits or other exclusive

features appear. In some cases, however, given significant phylogenetic proximity between two species of the same genus or two varieties of the same species, plant samples were obtained for exsiccate comparisons and sometimes between each other. On the other hand, exsiccate sampling is paramount for classification or the determination of new taxon (Barroso, 2002).

Photographic recordings were taken with a Canon DS camera by visiting the trails, using personal protective equipment as well as vertical and climbing equipment.

Subsequently, a questionnaire was developed containing open and closed questions to identify climber knowledge and flora relationships.

3. Results

A total of 44 plant species, whose detailed description will be published elsewhere (manuscript under preparation), were identified. A characteristic species distribution is observed, as the selected trails are located on different outcrop faces, presenting different abiotic and biotic factors, i.e. humidity is higher on southern outcrops (Porembski et al. 2007.), while solar incidence is higher on northern faces (Saddi 2010; Meirelles et al., 1999). After flora characterization the routes, climber was assessed. A total of 93.2% of respondents indicated they understand the importance of conservation units, and are aware of the responsibilities and the fact that they are performing sport activities within these areas. When asked about the appropriate conduct for the sites, answers included “Preserve local fauna and flora”, “Ecosystem and trail maintenance, management plans”, “Keep fauna and flora free from human interference” and “Preservation, research and leisure”.

In addition, most respondents (96.6%) answered they are aware of local plants on trails, and most were able to name some species, although some popular or generic classifications such as "cacti" or "bromeliads" were indicated. Most respondents (96%) did not have higher education or advanced botany experience, but cited high school as a source of plant information. A small portion of the interviewed climbers reported learning about plants by their own means, through climbing clubs, books, or friends. This data indicates most climbers see the plants but are unable to identify them.

4. Discussion

The flora survey and classification indicates a restricted (Porembski, 2000; Meirelles, 1999) and diverse (Parmentier; Hardy, 2009) biodiversity in Rio de Janeiro rocky outcrops, which can be observed in climbing trails.

The questionnaires indicate that most of the sport community can recognize some plant species, even though only superficially and by their popular names, even though botany content is mandatory in Brazil, listed in the main national (Brazil, 1997; 2002; 2006; 2018) and state (Rio de Janeiro, 2012) guiding documents.

A small percentage of this knowledge was obtained through climbing clubs, books or with friends, indicating the importance of both formal and informal teaching integrated with the construction of botany knowledge.

Over 93% of the climbers do suffer plant blindness (Wandersee; Schussler, 2001), considering that they do indeed see the plants during their sports activities, but they fail to individually recognize most species as pointed out by Balding and Williams (2016). This indicates that, just as vision impairments and other physical senses are classified into stages (from complete blindness to nearsightedness, astigmatism and mild hypermotropy), so should mental vision, as noted by the plant blindness observed herein, which requires investigation. The noted “plant myopia” can also be interpreted as apparently not related to plant proximity, like in conventional myopia, as many climbers move within inches of vegetation during their sports activities (Daflon, 2010). Therefore, this myopia can be corrected through teaching regarding the local botanical species, their importance, their environmental functions, as well as actual or potential, as indicated by Da Fonseca-Kruel et al. (2005).

Most respondents indicates care and interest in learning more about the botanical species they encounter during their sports activities, as well in watching over the local flora, precisely because they practice their activities within Conservation Units, which are directly linked to environmental issues. Technical advice in this regard in mountaineering institutions, such as the Rio de Janeiro State Mountain Sports Federation (FEMERJ), is already being conducted, where the Federation acts through lectures and direct affirmative actions in order to maintain the local biodiversity, alongside the managers of the Conservation Unit listed herein. However, a knowledge gap is still noted, which must be filled concerning knowledge on existing plants near climbing trails. In this regard, basic climbing courses applied by the Rio de Janeiro Guide and Scale Professionals Association (AGUIPERJ) comprise a significant opportunity to fill this knowledge gap, currently discussed at technical council meetings and among the institution’s board.

Management plans foresee climbing activities and create rules and guidelines for this practice, in addition to those established in the MONA Sugar Loaf management plan, consisting in plans to open new climbing routes due to excess human impacts.

Any kind of ban on climbing is seen as a problem, as it would lead climbers to look for other locations and impact other vegetation areas in unprotected areas. Thus, environmental actions should be conducted in order to conserve the assessed areas, creating further links between local climbers and rocky outcrops.

The development of activities concerning environmental and botanical knowledge construction and contextualization in the short, medium and long term, in the fields of research of Environmental Interpretation, Environmental Education, Botany Teaching and Ethnobotany are, therefore, paramount, given their inter- or transdisciplinary character. (De Oliveira et al., 2009). These may focus on climbing trail plants at the three main Conservation Units in Rio de Janeiro, followed by short-term action instructions, such as practical activities as recommended by Salatino and Buckeridge (2016), presented in a contextual manner as indicated by Ursi et al. (2018).

In this context, ethnobotany construction takes place in a biological diversity and cultural diversity scenario that constitutes a heritage of immense value to be conserved considering that both Brazilian and foreign climbers of many different ages make use of the Rio de Janeiro climbing trails (De Oliveira et al., 2009).

5. Conclusions

Over 90% of the interviewed climbers understand the importance of protected areas and “see” local plants during their sports activities. Therefore, as they note the plants, they do suffer plant blindness, because, they cannot identify most species, indicating “plant myopia”, although most respondents have studied botanical mandatory content at the mid-level schooling range. Therefore, a mental vision deficiency gradation related to plant blindness is noted, as observe in physical vision, ranging from lack of total plant vision, or botanical blindness, to “plant myopia”, where species are seen but not observed. light botany. Although high school is an important source of botanical content, but in general, does not prevent botanical blindness. This may occur with other contents and significance at other intensities, which requires further investigation. Gaps in climbing course content and the protected areas surveyed herein were noted regarding botany and environmental information which must be filled, especially aimed at the adult lay public.

6. References

Balding, Mung; Williams, Kathryn Jh (2016). *Plant Blindness And The Implications For Plant Conservation*. *Conservation Biology*, V. 30, N. 6, P. 1192-1199. Retrieved 2019 September 30 Doi 10.1111/Cobi.12738

Barroso, Graziela Maciel Et Al. (2002). *Sistemática De Angiospermas Do Brasil*. Vol. 1. Viçosa, Ufv.

Brasil (1997). *Parâmetros Curriculares Nacionais. Secretaria De Educação Fundamental*. Brasília: Mec/ Sef,. Retrieved 2019 September 30 From <Http://Portal.Mec.Gov.Br/Seb/Arquivos/Pdf/Livro01.Pdf>

Brasil (2002). *Pcn+ Ensino Médio: Orientações Educacionais Complementares Aos Parâmetros Curriculares Nacionais. Ciências Da Natureza, Matemática E Suas Tecnologias*. Brasília: Mec, Semtec.

Brasil (2006). *Orientações Curriculares Para O Ensino Médio. Ciências Da Natureza, Matemática E Suas Tecnologias*. Brasília: Mec, Seb. Retrieved 2019 September 30 From Http://Portal.Mec.Gov.Br/Seb/Arquivos/Pdf/Book_Vol

Brasil (2018). Ministério Da Educação. Secretaria Da Educação Básica. *Base Nacional Comum Curricular*. Brasília, Df. Retrieved 2019 September 28 From Http://Basenacionalcomum.Mec.Gov.Br/Images/Bncc_Ei_Ef_110518_Versaofinal_Site.Pdf

Carauta, J. P. P. & Oliveira, R.R. (1984). *Plantas Vasculares Dos Morros Da Urca, Pão De Açúcar E Cara De Cão*. *Rodriguésia* 36: 13-24. Doi 10.1590/2175-78601984365902

Daflon, Flavio (2012). *Guia De Escaladas Da Floresta: Escaladas No Maciço Da Tijuca 2ª Ed*. Rio De Janeiro: Companhia Da Escalada.

De Oliveira, Flávia Camargo *Et Al.* (2009) *Avanços Nas Pesquisas Etnobotânicas No Brasil*. Acta Bot. Bras, V. 23, N. 2, P. 590-605. Retrieved 2019 September 30 From <Http://Www.Scielo.Br/Pdf/Abb/V23n2/V23n2a31>

Dressler, R.L. (1981). *The Orchids: Natural History And Classification*. Harvard, Harvard University.

Da Fonseca-Kruel, Viviane Stern; Silva, Inês Machline; Pinheiro, Cláudio Urbano B (2005). *O Ensino Acadêmico Da Etnobotânica No Brasil*. Rodriguésia, P. 97-106.

Fernandez, Annelise Caetano Fraga (2011). Um Rio De Florestas: Uma Reflexão Sobre O Sentido Da Criação Dos Parques Na Cidade Do Rio De Janeiro. Estudos Históricos, V. 24, N. 47, P. 141-161. Retrieved 2019 September 30 From <Http://Www.Scielo.Br/Pdf/Eh/V24n47/N47a08>

Instituto Chico Mendes De Conservação Da Biodiversidade, Retrieved 2019 March 13 From <From Http://Www.Icmbio.Gov.Br/Parnatijuca/>

Martinelli, Gustavo (2008). *Bromeliaceae Da Mata Atlântica Brasileira: Lista De Espécies, Distribuição E Conservação*. Rodriguésia, Vol.59, N.1, P.209-258.

Meirelles S. T.; Pivello V. R.; Joly C. A (1999). *The Vegetation Of Granite Rock Outcrops In Rio De Janeiro, Brazil, And The Need For Its Protection*. Environmental Conservation 26 (1). P:10–20. Doi 10.1017/S0376892999000041

Parmentier, I. & Hardy, O.J. (2009). *The Impact Of Ecological Differentiation And Dispersal Limitation On Species Turnover And Phylogenetic Structure Of Inselberg's Plant Communities*. Ecography 32: 613-622. Doi 10.1111/J.1600-0587.2008.05697.X

Porembski, S. & Barthlott, W. (2000). *Inselbergs. Biotic Diversity Of Isolated Rock Outcrops In Tropical And Temperate Regions*. New York, Springer-Verlag. Doi 10.1007/978-3-642-59773-2

Porembski, S. (2007). Tropical Inselbergs: Habitat Types, Adaptive Strategies And Diversity Patterns. *Brazilian Journal Of Botany*, V. 30, N. 4, P. 579-586. Doi 10.1590/S0100-84042007000400004

Prefeitura Da Cidade Do Rio De Janeiro, Retrieved 2019 September 30 From <Http://Www.Rio.Rj.Gov.Br>

Ribeiro, K.T. (2000). *Estrutura, Dinâmica E Biogeografia De Ilhas De Vegetação Rupícola Do Planalto Do Itatiaia, Rj*. Tese De Doutorado, Universidade Federal Do Rio De Janeiro, Rio De Janeiro, 117p.

Rio De Janeiro (2012). *Currículo Mínimo 2012 - Ciências E Biologia*. Secretaria De Educação Do Estado Do Rio De Janeiro. Retrieved 2019 September 30 From Https://Www.Researchgate.Net/Publication/308765361_Currículo_Minimo_-_Ciencias_E_Biologia_Seeduc_-_2012

Saddi, Eduardo Martins (2008). *Orchidaceae Dos Afloramentos Rochosos Da Pedra Da Gávea, Parque Nacional Da Tijuca, Rio De Janeiro*. Tese De Doutorado, Instituto De Pesquisas Jardim Botânico Do Rio De Janeiro, 119 P.

Salatino, Antonio; Buckeridge, Marcos (2016). Mas De Que Te Serve Saber Botânica? *Estudos Avançados*, V. 30, N. 87, P. 177-196. Doi 10.1590/S0103-40142016.30870011

Ursi, Suzana Et Al. (2018). Ensino De Botânica: Conhecimento E Encantamento Na Educação Científica. *Estudos Avançados*, V. 32, N. 94, P. 7-24. 10.1590/S0103-40142018.3294.0002

Van Der Pijl, L. (1982). *Principles Of Dispersal In Higher Plants*. New York, Ed.3, Springer-Verlag.

Vieira, Sonia (2000). *Como Elaborar Questionários*. São Paulo, Editora Atlas Sa.

Wandersee, J.H.; Schussler, E (2001). *Toward A Theory Of Plant Blindness*. Plant Science Bulletin, Columbus, V. 47, N. 1, P. 2-9. Retrieved 2019 September 30 From <https://Botany.Org/Plantsciencebulletin/Psb-2001-47-1.Php>

Porcentagem de contribuição de cada autor no manuscrito

André Micaldas Corrêa – 45%

Wayler Muñoz Piñeiro Neto – 35%

Luiz Anastácio Alves – 20%