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Checklist of the rupicolous vascular plant species on inselbergs in the Monumento Natural dos Pontões Capixabas, Espírito Santo, Brazil

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Abstract

Background

Inselbergs are granitic and/or gneissic rocky outcrops and, in Brazil, the dome-shaped ones are called sugarloaves (*pães de açúcar*). They have an extremely specialized vegetation with high levels of endemism. Despite this, they are poorly studied and highly degraded. In northeastern Espírito Santo State, in southeastern Brazil, the *Monumento Natural dos Pontões Capixabas* (MONAPC) is a federal protected area created to guard some inselbergs threatened by mining, which is one of the main activities in the state. In this work, we provide the first checklist of the rupicolous vascular plant species in this protected area, which is based on field expeditions and searching for occurrence records in virtual herbaria.

New information

We recorded 105 species in 36 families and 74 genera that inhabit the vegetation islands on the inselbergs within the official limits of MONAPC. A new species of *Pleroma* (Melastomataceae) was discovered and, it is being described.

Keywords

Taxonomy, floristics, rocky outcrops, granite, protected areas

Introduction

Brazil is the country with the highest richness of vascular plant species in the world (Forzza et al. 2012), including 35,683 species of terrestrial plants (B.F.G. 2021). Around half of the species that occur in Brazil have been recorded in the Atlantic Forest, one of the most biodiverse (B.F.G. 2021, Marques and Grelle 2021) and decimated biomes in the world; only around 11% of the original forest remains (Carlucci et al. 2021, Ribeiro et al. 2009). The Atlantic Forest domain is a mosaic of different vegetation types and associated ecosystems (Scarano 2002), and inselbergs are one of the frequent landscapes in this domain, which are enormous rock hills that rises abruptly from a plain (Porembski and Barthlott 2000, Porembski 2007, Twidale 1981, Twidale 1982, Varajão and de Alkmim 2015). These rocky outcrops are composed of granite and/or gneiss, are isolated or form chains (Porembski 2007, Twidale 1981), and are present in other Brazilian domains (Barbosa-Silva et al. 2022, Safford and Martinelli 2000). Although, they are more frequent on the eastern coast in a region called Sugarloaf Land (SLL) (de Paula et al. 2020).

Inselbergs, from the German words *insel* (= island) and *berg* (= mountain), are “terrestrial islands” characterized by their isolated and severe environmental conditions that are considered desert microclimates with high temperatures and insolation, a high rate of evapotranspiration, and low humidity (Porembski 2007). When present, soil occurs in thin layers in depressions and on flat areas and is incapable of retaining rainwater that runs down the impermeable rock (Porembski and Barthlott 2000, Porembski and Watve 2005, Porembski 2007, Szarzynski 2000). Due to these extreme characteristics, the vegetation in these environments sharply differs from that in surrounding areas and is an extremely specialized flora with a high number of endemic species (de Paula et al. 2020, Porembski et al. 1998, Porembski 2007).

In Brazil, there are few protected areas of the rich flora on inselbergs (de Paula et al. 2020, Martinelli 2007). The Monumento Natural dos Pontões Capixabas (MONAPC) is a protected area that includes the greatest concentration of inselbergs in southeastern Brazil, is within the SLL region in the state of Espírito Santo, and still lacks biological inventories. Floristic inventories are important because they answer a basic and essential question in relation to a protected area: which species occur there? After finding out which species inhabit a specific area, it is possible to evaluate the conservation status of each of them and, based on the threat categories they are in (Fraga et al. 2019, Antonelli et al. 2020), determine conservation actions (Mace 2004). A floristic list is also fundamental when creating a management plan, a technical document that is fundamental for an official protected area (Ministério do Meio Ambiente 2000) because it establishes guidelines and norms for conservation actions according to the objectives defined when creating the protected area. Thus, with the goals of contributing to sustainable management and decision making, the objective of this work was to conduct a floristic inventory of the rupicolous plant species on the inselbergs within the legal limits of MONAPC.

Project description

Study area description: MONAPC is a federal conservation unit. It is about 17,000 ha and within two municipalities, 12,000 ha in Pancas and 5,000 ha in Águia Branca, in northeastern Espírito Santo State (Fig. 1). In 2002, this protected area was urgently created as a national park to preserve the granite outcrops from being mined, the main threat to these ecosystems and one of the largest economic activities in the state that is responsible for 75% of the exported ornamental rock in Brazil (Sardou Filho et al. 2013). However, since it was a national park, the local population was technically not allowed to inhabit the region inside the legal limits of the park (Ministério do Meio Ambiente 2000), and a socioeconomic conflict started in the region. This resulted in the need to reclassify the protected area into a category that would allow the population to stay on their land. Thus, in 2008, the national park was finally reclassified as a natural monument so these people could stay in the region (Barbosa 2013, Bortoleto 2015, Spamer 2017).

MONAPC is divided into two microregions in the state, the Northeast Microregion and Central-West Microregion, which have various environmental problems. They have the greatest number of municipalities in the state that are in a process of desertification, according to a national program that was developed to assist extremely dry areas in Brazil (*Programa de Ação Nacional de Combate à Desertificação e Mitigação dos Efeitos da Seca* no Brasil) (Instituto Jones dos Santos Neves 2021). The Northeast Microregion is less than 8% native forest, less than 1% of it is within protected areas and around 60% of it is pasture, which is the highest percentage in the state (Instituto Jones dos Santos Neves 2021I). The Central-West Microregion is around 12% native forest, less than 3% of it is officially protected, and the main soil use is cultivating coffee (around 16%) (Instituto Jones dos Santos Neves 2021). For the two microregions together, around 11% of the agricultural areas have degraded soils, around 18% of the coffee crops have degraded soils, and around 21% of the pastures are degraded (Barreto and Sartori 2012). The rural properties within the legal limits of the protected areas are small and mostly specialize in cultivating conilon coffee (*Coffea canephora* Pierre ex A.Froehner) (Ferrão et al. 2019) or farming cattle (Instituto Jones dos Santos Neves 2021).

Weather

The Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística) classifies the climate of northern Espírito Santo (Instituto Brasileiro de Geografia e Estatística 2002) as hot and dry. However, in the central region in the direction of the southeastern region the climate is mildly hot to mild mesothermal. This is due to the elevation of this region, which is influenced by Serra do Caparaó where the climate is median to mild mesothermal with average temperatures between 10ºC and 15ºC. In the southeastern part the state, especially the coastal region, the climate is hot, but within the subcategory very humid, and gradually changes to the subcategory semi-humid in the extreme southern part of the state (Fig. 2). According to the IBGE classification, the climate of MONAPC, which is in northeastern Espírito Santo, is hot and dry. In a more general

classification by Köppen (1936), MONAPC is in the Tropical Zone and has a tropical climate with a dry winter and rainy summer (Aw).

The weather stations closest to MONAPC are Aimorés (A534 -19,532778, -41,090833; 287,74 a.s.l.), around 30 km to the southeast, and Mantena (A540 -18,780620, -40,986505; 254,91 a.s.l), around 40 km to the northeast. Data from the Mantena station showed that the average temperature of the coldest months (June to August) is 21ºC and the sum of the precipitation for the period of 92 days is less than 10 mm. During the hottest months (January to March), the average temperature is 27ºC, and the precipitation increases considerably to nearly 300 mm for the entire period. During this work, the rainiest months were October 2021 to February 2022; in December there was 277 mm of rain (Fig. 3, A). Graphs of the precipitation and average temperature from the Aimorés station (which were not available for the Mantena station) demonstrate a climate pattern that is very demarcated for the region, with dry winters and rainy summers (Fig. 3, B and C).

Geology

Inselbergs are very old outcrops formed underground and revealed by weathering on the surface (Varajão and de Alkmim 2015). They can be various types of rock and occur in different climates, but the inselbergs in MONAPC are made of granite and gneiss from the crystalline core of the *Araçuaí* orogen, formed during the separation of Gondwana at the end of the Neoproterozoic and beginning of the Paleozoic (Varajão and de Alkmim 2015). The three types of rock that form the inselbergs in MONAPC are *Ataléia* and *Carlos Chagas* granites (575 m.y.a), and Charnockito *Aimorés* (520 to 490 m.y.a). The most frequent is *Carlos Chagas* leucogranite, which is formed by large crystals of feldspar in a matrix of plagioclase, quartz, and garnets (Varajão and de Alkmim 2015).

Inselbergs are classified as lowlands when they are up to 1000 m above sea level (*sensu* de Paula et al. (2016)) and highlands when they exceed this height (*sensu* Safford (1999)). In MONAPC, 195 outcrops have been recorded (OpenStreetMap Foundation 2022) that are up to 1000 m a.s.l., so they are considered lowlands. The region predominantly has red-yellow latosols (halic or dystrophic) with a clayey texture associated with the crystalline rocks of the inselbergs (Instituto Brasileiro de Geografia e Estatística 1987).

Sampling methods

Description: MONAPC and its surroundings are in the Atlantic Forest domain, and the main forest formation in the region is seasonal semideciduous forest, which encircles the inselbergs (Saiter et al. 2021). Fragments of riparian forest also occur along streams in the region. On the rock surface of the inselbergs there is a mosaic of vegetation types that are organized into vegetation patches or islands surrounded by bare rock. Here, we use the term vegetation island to designate diverse microhabitats on the inselbergs that are totally exposed to the xeric conditions of these environments, from fissures and hollows in the rock to carpets of monocotyledons directly fixed to bare rock (Porembski et al. 1997, Seine et al. 2000). The focus of our study was the species of vascular plants in these

microhabitats, which are considered typical vegetation of inselbergs (Seine et al. 2000). The vegetation islands mainly comprise plants forming carpets, such as species of Velloziaceae, Bromeliaceae, and Cyperaceae (Porembski and Barthlott 2000) that grow directly on bare rock or thin layers of substrate. Other vegetation types in MONAPC were also visited, such as scrub vegetation with shrubs and trees (Oliveira-Filho 2013, Rizzini 1997). These are on flat parts of the inselbergs, which favor sedimentation that results in shallow soil with forest formations. Scrub vegetation is very common on the flat ridges of some inselbergs, in depressions on the rock surface, and in transitions areas between the forest matrix and exposed rock. The collections made outside vegetation islands were not included on the final list, but among them there are important new occurrence records for Espírito Santo, so these species are discussed.

Sampling description: The field expeditions to collect fertile individuals were made in September and November 2021 and January, March, and June 2022, which covered the dry and rainy seasons. On the first expedition in MONAPC, we drove on dirt roads among the 195 mapped inselbergs (OpenStreetMap Foundation 2022) to look for those with less steep slopes that could be safely accessed without using climbing equipment. Due to the lack of collections from within the official limits of the MONAPC, which was found during the preliminary analysis of records from the region, we tried to visit as many mapped points as possible on the first expedition. We returned to some of the inselbergs to make additional collections, but some points were only visited once.

The collected material was preserved in alcohol until it arrived in the herbarium where it was processed (Mori et al. 1989). All the collections were deposited in the RB herbarium and duplicates were sent to the VIES and SPF herbaria; some duplicates were also sent to specialists at the HUEFS, CEN, UPCB, and HUFU herbaria (acronyms according to Thiers (2023)). Leaf fragments were separated and dehydrated in silica before preserving the collections in alcohol. These samples were deposited in tissue collection at RB herbarium (Instituto de Pesquisas Jardim Botânico do Rio de Janeiro 2023).

The specimens were identified by comparing them with identified material at RB, consulting taxonomic articles, consulting keys in Flora e Funga do Brasil (2023), and sending photos and/or duplicates to specialists. Information about life form, substrate, vegetation type, domain, and occurrence in federative units were taken from Flora e Funga do Brasil (2023) using the interface PlantMiner (Carvalho 2023). Flora e Funga do Brasil (2023) follows Angiosperm Phylogeny Group (2016) and The Pteridophyte Phylogeny Group (2016).

All analyses with the occurrence databases were executed in the R language (R Core Team 2022) with the development software R Studio (R Studio Team 2022) and the software Excel® (Microsoft® 2022). The following R packages were used to manipulate data: plyr (Wickham 2011), dplyr (Wickham et al. 2022), magrittr (Bache and Wickham 2022), and sqldf (Grothendieck 2017).

Previous Floristic Inventories

To compare the results of this work with other studies conducted on inselbergs in Espírito Santo, sublists were compiled from Covre et al. (2021), Couto et al. (2017), Pena and Alves-Araújo (2017), and Esgario et al. (2009) (Table 1). These studies sampled vegetation islands and scrub vegetation. Since the methods differed from the present study, which concentrated on collecting on vegetation islands, we decided to make sublists for each study with species only from vegetation islands. The selection criterion of the species for the sublists was “herbaceous vegetation island,” “rupicolous substrate,” and “phytophysiognomy: vegetation on exposed rock” for Couto et al. (2017), Pena and Alves-Araújo (2017) and Covre et al. (2021), respectively. The last work does not explicitly mention scrub vegetation in the collection methodology; therefore, we only used species classified as rupicolous on the list.

New Occurrences

To identify the new occurrences, we used all the collections made by the authors from vegetation islands and other vegetation types in MONAPC. The new occurrences of species are based on the last version of Flora e Funga do Brasil (2023), which indicates the states, domains, and vegetation types where each species occurs. For Sugarloaf Land, we used the list from de Paula et al. (2020).

Step description: Vascular Plant Dataset

The list of species was constructed in four steps (Fig. 4):

1. We compiled all the occurrence records of vascular plant species from the municipalities of Pancas and Águia Branca, which were in the Reflora Herbário Virtual (2023) and Herbário Virtual da Flora e de Fungos (Centro de Referência e Informação Ambiental 2023) online databases. At the end of this step, we had 6,054 records (including duplicates) of 1,180 species.

2. A comparison was made between the species in SLL (which has 548 vascular plant species on vegetation islands; (de Paula et al. 2020)) and the database of the species compiled in step 1. Only records of corresponding species were kept, thus ensuring which species occur on vegetation islands. Of the 6,054 records, we kept 1,044 records of 184 species from vegetation islands (and occasionally scrub vegetation).

3. Records of vascular plants collected by the authors on vegetation islands within the MONAPC limits (85 records) were added to the step 2 database, resulting in 1,129 records and 206 species.

4. Records restricted to the official geographic limits of MONAPC (Instituto Chico Mendes de Conservação da Biodiversidade 2023) were selected to generate a “Checklist of the Rupicolous Vascular Plant Species in MONAPC *sensu stricto*.” Based on the step 2 database, we made another list called “Checklist of the Rupicolous Vascular Plant Species in MONAPC *sensu lato*,” which has the species that occur within the official geographic limits MONAPC and its surroundings in the municipalities of Pancas and Águia Branca.

The *sensu lato* list is the result of adding the *sensu stricto* list to the remaining species on vegetation islands on the list from step 2 that were not collected during our field expedition.

Geographic coverage

Description: The geographic coverage encompasses lowland inselbergs in , the Monumento Natural dos Pontões Capixabas (MONAPC) is a federal protected area in northeastern Espírito Santo State, southeastern Brazil

Coordinates: -19.245509, -40.766437 and -19.000903, -40.866024 Latitude; -19.102962, -40.868911 and -19.018078, -40.661117 Longitude.

Taxonomic coverage

Description: We provide the first "Checklist of Rupicolous Vascular Plant Species in MONAPC *sensu stricto*", which has 105 species distributed in 36 families and 74 genera (Suppl. material 1). This is the main list we use to discuss the results of the present work. We also provide a complementary list of species that occur in MONAPC and its surroundings (municipalities of Pancas and Águia Branca), which is called the "Checklist of Rupicolous Vascular Plant Species in MONAPC *sensu lato*" and has 206 species (Suppl. material 2), including some that potentially occur in MONAPC but were not sampled in the protected area during this study. The second list can serve as a guide during future complementary floristic studies in MONAPC.

Although we found a richness of 105 species in MONAPC, other works found much higher numbers: Covre et al. (2021) found 121 species on Pedra das Andorinhas, Couto et al. (2017) found 211 species on Pedra dos Pontões, Pena and Alves-Araújo (2017) found 302 species in the APA Pedra do Elefante, and Esgario et al. (2009) found 170 species in Alto Misterioso (Table 2). The low number of species found in MONAPC compared to the other floristic works conducted on inselbergs in Espírito Santo state could be due to differences in the methodology. As previously mentioned, we only sampled vegetation islands, while the other studies also sampled scrub vegetation (even though some studies did not explicitly refer to the term). Although, the richness is similar between our work and the sublists derived from other works when only species from vegetation islands are included. Thus, for vegetation islands, the present work reports more species than Covre et al. (2021) and Couto et al. (2017), with 66 and 87 species, respectively, but reports fewer than Pena and Alves-Araújo (2017), which cites 154 species.

The angiosperm lineage is the richest, with 95 species distributed in 69 genera and 32 families. The richest families on the *sensu stricto* list are Bromeliaceae (13 spp.), Asteraceae (10 spp.), Melastomataceae (8 spp.), Orchidaceae (7 spp.), Araceae (5 spp.), and Apocynaceae and Fabaceae (4 spp. Each). Together, these families represent 48% of all the species on this list (Table 3). The richest genera are *Pleroma* (6 spp.) and *Anthurium* (4 spp.), followed by four genera with three species each: *Anemia*, *Dioscorea*, *Dyckia,* and

Selaginella. Fifteen genera have 2 species each and 52 genera are represented in the local flora by only one species (52%) (Table 4, Fig. 5)

There are 10 species of lycophytes and monilophytes. The lycophytes are only represented by Selaginellaceae (*Selaginella*, 3 spp.), while the monilophytes are represented by seven species and three families, Anemiaceae and Pteridaceae with three species each and Blechnaceae with one species. The richest genus is *Anemia* (3 spp., Anemiaceae), followed by *Cheilantes* (Pteridaceae) with two species and *Doryopteris* (Pteridaceae) and *Blechnum* (Blechnaceae) with one species each.

Most of the species found in this study have an exclusively herbaceous life form (48 spp.; 50%), followed by shrubs (16 spp.; 17%), vines and subshrubs (5 spp. each; 5%), trees (4 spp.; 4%), and one species of palm (*Syagrus ruschiana* (Bondar) Glassman). Seventeen species had more than one life form (10%) (Fig. 5, Suppl. material 1).

The most species-rich families in this study are the same as those in other works conducted on inselbergs in Espírito Santo. The richest family was Bromeliaceae, as found by Covre et al. (2021) and Pena and Alves-Araújo (2017); however, this was the second richest family in Couto et al. (2017) (Table 3). Asteraceae and Melastomataceae ranked among the first four positions in all the works, including the present study. According to Porembski et al. (1997) and Porembski and Watve (2005), Bromeliaceae, Orchidaceae, and Melastomataceae are typical families of inselbergs in the Southeast Region of Brazil. In all the works, the genera typical of inselbergs ranked among the first five positions, such as *Pleroma* (Melastomataceae), *Pitcairnia* (Bromeliaceae), *Sinningia* (Gesneriaceae), *Dyckia* (Bromeliaceae), *Vellozia* (Velloziaceae), *Alcantarea* (Bromeliaceae), and *Anthurium* (Araceae).

The richest families on the inselbergs in MONAPC are also the most diverse in the Atlantic Forest domain in Espírito Santo State, such as Orchidaceae, Bromeliaceae, Fabaceae, Asteraceae, Myrtaceae, Rubiaceae, Melastomataceae, Apocynaceae, Cyperaceae, and Poaceae (Dutra et al. 2015). These are also among the most representative families on inselbergs in Sugarloaf Land (de Paula et al. 2020) and alternate among the top positions, which reinforces the connection between the species assemblages in the different ecosystems and phytophysiognomies in the Atlantic Forest domain (Neves 2017, Scarano 2002. Species in the forest matrix colonize inselbergs, and those in temporary refuges on inselbergs (e.g., during cycles of environmental changes) also return to the matrix (Burke 2002a, Burke 2002b, Burke 2003, Porembski 2007. Thus, as considered for ocean islands (e.g., Heaney (2007)), it is believed that populations on inselbergs can be sources or sinks, depending on the environmental niche of the species (Burke 2003). Long-term monitoring of selected species populations, dated phylogenies, and biogeographic approaches are needed to better explain if “source-sink” effects exist and how they operate.

There were 33 exclusively rupicolous species and 32 exclusively terrestrial species. Twenty-one species were both rupicolous and terrestrial. Only one species was exclusively epiphytic (*Stigmatodon vellozicolus* (Leme & J.A.Siqueira) D.R.Couto & A.F.Costa), while seven species were epiphytic and rupicolous. Finally, combined substrates, rupicolous/

hemiepiphytic and aquatic/terrestrial, had only one species each. Interestingly, Bromeliaceae and Orchidaceae are generally the richest families in the Atlantic Forest and mostly represented by epiphytes in forest physiognomies, but on inselbergs they are represented by rupicolous groups. It is speculated that vegetation rich in epiphytes in the Atlantic Forest region (Benzing 2000, Givnish et al. 2014) could influence the high richness of bromeliad species on inselbergs in southeastern Brazil, or vice versa, especially for Tillandsioideae (de Paula et al. 2016). This can culminate in the evolution of species that are efficiently adapted to the severe environmental conditions in canopies and on rocky outcrops (Porembski et al. 1998). More studies are needed to understand to what extent epiphytic bromeliads (of a regional pool of species) share preferences for a similar habitat with rupicolous elements of inselbergs.

Among the species recorded in MONAPC, fourteen are on the Brazilian red list (Ministério do Meio Ambiente 2022) under one of the threatened categories (3 CR, 6 EN, 5 VU) and 25 are on the red list for Espírito Santo State (Espírito Santo 2022) under one of the threatened categories (5 CR, 9 EN, 11 VU). The family with the greatest number of threatened species is Bromeliaceae (8 spp.), followed by Orchidaceae and Melastomataceae (4 spp. each) and Asteraceae and Anemiaceae (2 spp. each). Each of the remaining 12 families have one threatened species (Table 5). Only five species are classified in the categories on both lists: *Orthophytum zanonii* Leme (CR), *Kielmeyera rupestris* Duarte (CR), *Stigmaphyllon crenatum* C.E.Anderson (CR), *Merianthera pulchra* Kuhlm. (VU), and *Epidendrum robustum* Cogn. (VU).

Nomenclatural types: According to the Reflora and SpeciesLink virtual herbaria, 29 species of plants were described from specimens from Pancas and Águia Branca over the last 80 years (Table 6). The oldest type collections are from 1942, *Ixora emygdioi* (Bruno, E.A. 191), and 1977, *Mandevilla grazielae* (G.J.Sheperd 5869), which is a typical species of inselbergs, and were described 70 and 29 years after being collected for the first time, respectively. For 20 years there were no collection records in the region and in 2003 two new species of Melastomataceae were collected and described 11 and 12 years later. The most types were collected in 2006 (11 collections), of which some were described a decade later. In 2007 and 2008 there were 5 species each, and in 2010 there were 2 species. After a hiatus of 5 years without type collections, 2016 and 2017 each had one collection. The time for a species to be described is highly variable, and it depends on the specialists in the families. Eighteen species took 5 to 13 years to be described, while 14 species took less than 5 years.

New records and the gap in collections within the official limits of MONAPC : A new species of *Pleroma* (Melastomataceae) was discovered, collected in five locations during the present work, and it is being described.

For Sugarloaf Land, we found eight new records of species: *Bougainvillea spectabilis* (Nyctaginaceae), *Canna paniculata* (Canabaceae), *Dioscorea campestris* (Dioscoreaceae), *Erechtites hieracifolius* (Asteraceae), *Ipomoea quamoclit* (Convolvulaceae), *Lepidaploa muricata (Asteraceae)*, *Polygala glochidiata* (Polygalaceae), and *Porophyllum ruderale* (Asteraceae) (Table 7). Among these new occurrences, *B. spectabilis, C. paniculata, D.*

campestris, P. glochidiata are widely distributed or ruderal species, which occur in anthropized areas and have hundreds of records in the virtual herbaria (Table 8). There are three new records for vegetation islands, *P. ruderale*, *E. hieracifolius* and *I. quamoclit*, which occur in anthropized areas throughout the country (Table 8) and are weeds in crops and pastures (Agrolink 2023, Marques et al. 2020).

For the state of Espírito Santo, nine new records of species were recorded: *Baccharis glutinosa, Bradea brasiliensis, Cheilanthes regnelliana, Herreria salsaparilha, Lepidaploa muricata, Pleroma vimineum, Stachytarpheta gesnerioides, Stillingia dichotoma*, and *Tabebuia reticulata* (Table 7). Unlike *Baccharis glutinosa*, which is widely distributed in ten states and has around 600 records in virtual herbaria, the remaining species have fewer records and only occur in a few states. *Bradea brasiliensis, Stillingia dichotoma*, *Pleroma vimineum,* and *Tabebuia reticulata* only occur in one state and have few records in the Reflora and SpeciesLink virtual herbaria (Table 8).

Thirteen species are not registered for rocky outcrop vegetation on Flora e Funga do Brasil (2023): *Aechmea lingulata*, *Aechmea ramosa*, *Baccharis glutinosa*, *Bougainvillea spectabilis*, *Canna paniculata*, *Dioscorea campestris*, *Erechtites hieracifolius*, *Herreria salsaparilha*, *Ipomoea quamoclit*, *Lepidaploa muricata, Pecluma plumula*, *Porophyllum ruderale*, and *Stachytarpheta gesnerioides*. *Aechmea lingulata* and *Aechmea ramosa* were found on huge boulders that probably fell from nearby inselbergs, and these boulders are also considered rocky environments.

Five species are endemic to rocky outcrops in Espirito Santo, which are in four families, including only one species of Bromeliaceae, Araceae, and Asteraceae: *Orthophytum zanonii* Leme (CR), *Anthurium marcusianum* Theoófilo, L.Kollmann & Sakur. and *Cololobus argenteus* M.Monge & Semir (EN), respectively (Fig. 6). *Orthophytum zanonii* was only known from two records from the "*Pedra do Vidal Krause*" inselberg, which is a popular tourist point in the region. In this work, we recorded another occurrence of this species on an inselberg on private property. The remaining species are *Merianthera burlemarxii* Wurdack (EN) and *Pleroma penduliflorum* Fraga & P.J.F.Guim in the family Melastomataceae. Of the five species, three are in the two most threatened categories on the red list for Espírito Santo State (Espírito Santo 2022), which are cited above in parentheses after the species name. It is important that these records were made within a protected area. This ensures the plants are protected from mining, which is the greatest threat to inselbergs and one of the main economic activities in Espírito Santo.

Widely distributed species that are weeds (Lorenzi 2008) were collected on vegetation islands on the inselbergs in MONAPC and are included on the *sensu stricto* list. These species, which are exotic or native, were collected to help define the amount of invasion in this vegetation. We collected *Melinis repens* (Poaceae), which is an exotic African grass that is invasive on all the inselbergs visited. This species has already been described as a serious threat to Brazilian inselbergs (de Paula et al. 2015, Porembski et al. 2016). Inselbergs are inadequate for agriculture and pastures, but in their surroundings these activities have replaced the forest matrix and when they do not directly touch the rocks there is transitional vegetation comprising shrubs, vines, grasses, and other herbs. Coffee

plantations and pastures are often colonized by these species, which are considered pests and are now also being recorded on the vegetation islands.

The new occurrence data described for Sugarloaf Land and Espírito Santo State once again reveals the need to increase collecting on inselbergs in southeastern Brazil, especially in highly diverse areas, such as MONAPC. Our preliminary studies of the occurrences based on online data for Pancas and Águia Branca found there is a major sampling deficiency within the official limits of MONAPC, since all the collections are from a few points (Fig. 7). Many collections have the locality "*Monumento Natural dos Pontões Capixabas*"; however, the geographic coordinates are outside the official limits. This occurs because there is no clear physical delimitation of the natural monument limits, such as signs, which is probably because there is no management plan for the area. Additionally, most of the collections were made near the paved roads in the region, and many of the collections are from the Três Pontões de Águia Branca region due to a major collection effort during the work of Pinto-Junior et al. (2021). A few collections with coordinates within the municipalities of Baixo Guandu and Nova Venécia were erroneously recorded for Pancas and Águia Branca. Localities with numerous collections, such as "*Pedra da Colina*" and "*Três Pontões de Águia Branca*", were not included in the protected area; they are a few kilometers outside the border of MONAPC. When MONAPC was being created, all these records would have been within the original planned area of 110,000 ha (Bortoleto 2015, Fig. 8). However, in the official decree, only 17,000 ha were included in the protected area (15%).

Usage licence

Data resources

Data package title: Checklists

Resource link: https://zenodo.org/record/7831887

Number of data sets: 2

Data set name: Checklist of Rupicolous Vascular Plant Species in MONAPC *sensu stricto*

Download URL: https://zenodo.org/record/7831887

Data format: csv

Description: Checklist of Rupicolous Vascular Plant Species in MONAPC (Monumento Natural dos Pontões Capixabas) *sensu stricto*, Espírito Santo State, Brazil. It contains 105 species occurring on lowland inselbergs and highlights species included in official lists of endangered flora. Taxonomy, Life Form, Substrate,

Vegetation Type, Occurrence Brazil and Domain according to Flora e Funga do Brasil (2023).

Column label	Column description
Lineage	Descent of the taxon
Family	Name of the family in which the taxon is classified
Genus	Name of the genus in which the taxon is classified
Epithet	Taxon specific epithet
Author	Author of the monography for the taxon
MMA 2022	Threat Status of the species according to Brazilian red listVU = Vulnerable, CR = Critically Endangered, EN = Endangered
ES 2022	Threat Status of the species according to Espírito Santo state's red listVU = Vulnerable, CR = Critically Endangered, EN = Endangered
Voucher	Indicates vouchers (collector and number)
Herbarium	Acronym of the herbarium according to Thiers
Code	Herbarium code of the voucher
Life Form	Life form(s) that the taxon can exhibit:Herb, Shrub, Subshrub, Tree, Climbing, Sucullent, Subtree, Dracenoid
Substrate	Place where the species occur:Rupicolous, Terrestrial, Epiphyte, Hemiepiphyte, Aquatic
Vegetation Type	Vegetation type(s) where taxon is present:a = Área Antrópica, b = Cerrado (lato sensu), c = Floresta Estacional Decidual, d = Floresta Estacional Semidecidual, e = Floresta Ombrófila Mista, f = Floresta Ombrófila (= Floresta Pluvial), g = Vegetação Sobre Afloramentos Rochosos, h = Campo rupestre, i = Campo de Altitude, j = Restinga, k = Caatinga (stricto sensu), l = Carrasco, m = Campo Limpo, n = Campo de Várzea, o = Savana Amazônica, p = Campinarana, q = Floresta Ciliar ou Galeria, r = Floresta de Igapó, s = Floresta de Terra Firme, t = Vegetação Aquática, u = Manguezal, v = Floresta de várzea, x = Floresta Estacional Perenifólia
Occurrence Brazil	Brazilian states where taxon occurs:AC = Acre, AL = Alagoas, AM = Amazonas, AP = Amapá, BA = Bahia, CE = Ceará, DF = Distrito Federal, GO = Goiás, ES = Espírito Santo, MG = Minas Gerais, MA = Maranhão, MS = Mato Grosso do Sul, MT = Mato Grosso, PA = Pará, PB = Paraíba, PE = Pernambuco, PI = Piauí, PR = Paraná, RJ = Rio de Janeiro, RN = Rio Grande do Norte, RO = Rondônia, RR = Roraima, RS = Rio Grande do Sul, SC = Santa Catarina, SE = Sergipe, SP = São Paulo, TO = Tocantins
Domain	Vegetation Domain or Biome where the taxon occurs:Ce = Cerrado, Ma = Mata Atlântica, Am = Amazônia, Ca = Caatinga, Pm = Pampa, Pa = Pantanal
Complete Scientific Name	The full scientific name with author

Scientific Name	Scientific name without author

Data set name: Checklist of Rupicolous Vascular Plant Species in MONAPC *sensu lato*

Download URL: https://zenodo.org/record/7831887

Data format: csv

Description: Checklist of Rupicolous Vascular Plant Species in the Monumento Natural dos Pontões Capixabas *sensu lato*, Espírito Santo State, Brazil. It contains 206 species occurring on lowland inselbergs and highlights species included in official lists of endangered flora. Taxonomy, Life Form, Substrate, Vegetation Type, Occurrence Brazil and Domain according Flora e Funga do Brasil (2023).

Column label	Column description
Lineage	Descent of the taxon
Family	Name of the family in which the taxon is classified
Genus	Name of the genus in which the taxon is classified
Epithet	Taxon specific epithet
Author	Author of the monography for the taxon
MMA 2022	Threat Status of the species according to Brazilian red listVU = Vulnerable, CR = Critically Endangered, EN = Endangered
ES 2022	Threat Status of the species according to Espírito Santo state's red listVU = Vulnerable, CR = Critically Endangered, EN = Endangered
Voucher	Indicates vouchers (collector and number)
Herbarium	Acronym of the herbarium according to Thiers
Code	Herbarium code of the voucher
LifeForm	Life form(s) that the taxon can exhibit:Herb, Shrub, Subshrub, Tree, Climbing, Sucullent, Subtree, Dracenoid
Substrate	Place where the species occur:Rupicolous, Terrestrial, Epiphyte, Hemiepiphyte, Aquatic
Vegetation Type	Vegetation type(s) where taxon is present:a = Área Antrópica, b = Cerrado (lato sensu), c = Floresta Estacional Decidual, d = Floresta Estacional Semidecidual, e = Floresta Ombrófila Mista, f = Floresta Ombrófila (= Floresta Pluvial), g = Vegetação Sobre Afloramentos Rochosos, h = Campo rupestre, i = Campo de Altitude, j = Restinga, k = Caatinga (stricto sensu), l = Carrasco, m = Campo Limpo, n = Campo de Várzea, o = Savana Amazônica, p = Campinarana, q = Floresta Ciliar ou Galeria, r = Floresta de Igapó, s = Floresta de Terra Firme, t = Vegetação Aquática, u = Manguezal, v = Floresta de várzea, x = Floresta Estacional Perenifólia

Occurrence Brazil	Brazilian states where taxon occurs:AC = Acre, AL = Alagoas, AM = Amazonas, AP = Amapá, BA = Bahia, CE = Ceará, DF = Distrito Federal, GO = Goiás, ES = Espírito Santo, MG = Minas Gerais, MA = Maranhão, MS = Mato Grosso do Sul, MT = Mato Grosso, PA = Pará, PB = Paraíba, PE = Pernambuco, PI = Piauí, PR = Paraná, RJ = Rio de Janeiro, RN = Rio Grande do Norte, RO = Rondônia, RR = Roraima, RS = Rio Grande do Sul, SC = Santa Catarina, SE = Sergipe, SP = São Paulo, TO = Tocantins
Domain	Vegetation Domain or Biome where the taxon occurs:Ce = Cerrado, Ma = Mata Atlântica, Am = Amazônia, Ca = Caatinga, Pm = Pampa, Pa = Pantanal
Complete Scientific Name	Scientific name with author
Scientific Name	Scientific name without author
SS	Species that are present in the checklist MONAPC *sensu strictoy* = Yes, n = No

Additional information

The flora of inselbergs has been neglected because these rocky outcrops are difficult to access and are commonly within anthropized matrices. The high levels of beta diversity (de Paula et al. 2021, Pinto-Junior et al. 2021), endemism, and genetically differentiated populations (e.g., Barbará et al. (2007), Hmeljevski et al. (2017), Hmeljevski et al. (2015), Palma-Silva et al. (2011), Nazareno et al. (2020)) on rocky outcrops, in southeastern Brazil, reinforce the fact that there is an insufficient number of inselbergs inside protected areas. MONAPC, in the heart of Sugarloaf Land, is the only protected area in Brazil that contains a considerable number of lowland inselbergs. Therefore, we hope that this work contributes to the MONAPC management plan (Ministério do Meio Ambiente 2000), which will be challenging due to competing interests to farm locally and preserve the unique biota.

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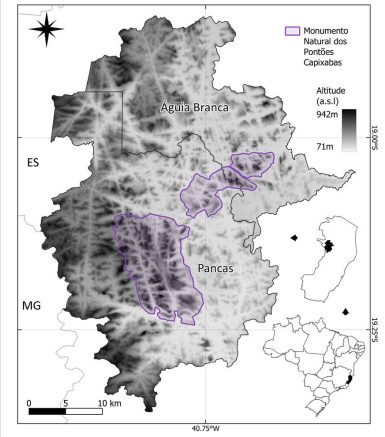

Figure 1.

Location map of Pontões Capixabas Natural Monument, Pancas and Águia Branca municipalities, Espírito Santo State, Brazil.

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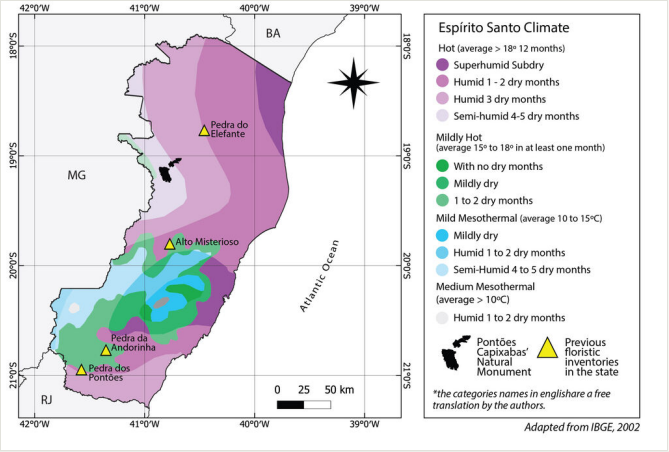

Figure 2.

Climate in Espírito Santo State, Brazil.

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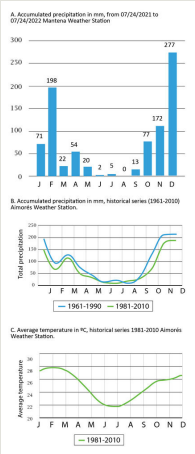

Figure 3.

Climate data from two weather stations near the Monumento Natural dos Pontões Capixabas, Espírito Santo State, Brazil.

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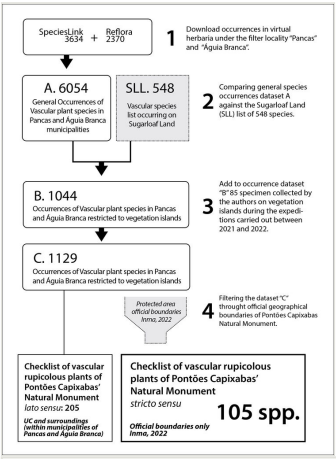

Figure 4.

Construction and validation of vascular plant dataset for inselbergs in the Monumento Natural dos Pontões Capixabas, Espírito Santo State, Brazil.

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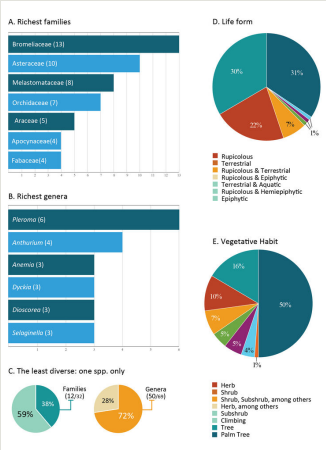

Figure 5.

Richest families and genera, least diverse families and genera, life forms, and vegetative habits in the Monumental Natural dos Pontões Capixabas, Espírito Santo State, Brazil.

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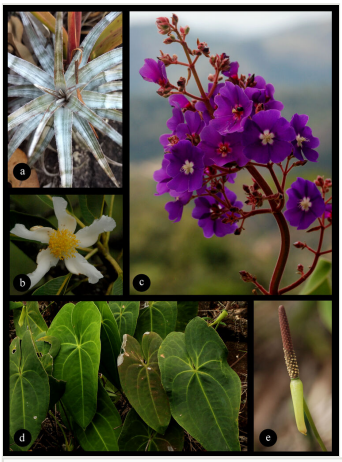

Figure 6.

Species endemic to vegetation on inselbergs in Espírito Santo State, according to Flora and Funga of Brazil (2023). **a** *Orthophytum zanonii*; **b** *Kielmeyera rupestris*; **c** *Pleroma sp.* **d, e** *Anthurium marcusianum*.

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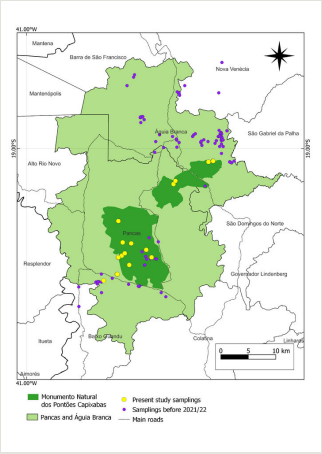

Figure 7.

The sampling gap within the official limits of the Monumental Natural dos Pontões Capixabas (MONAPC), Espírito Santo State, Brazil.

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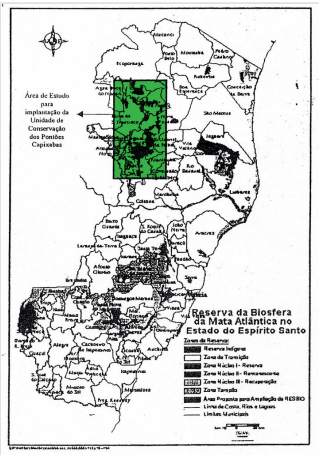

Figure 8.

Original area, 110,000 ha, for the "Monumento Natural dos Pontões Capixabas". Adapted from Bortoleto (2015).

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Table 1.

Floristic studies conducted on inselbergs of Espírito Santo State, southeastern Brazil. Rich. = Richness, F/G = Families/Genera, ES = region of Espírito Santo, Elev. = Elevation (m).

Study	Location	Rich.	F/G	ES	Elev.	Climate	Area
This study	MONAPC	105	36/74	Northeast	< 1000	Aw	17,000 ha
Pena and Alves-Araújo (2017)	APA Pedra do Elefante	302	74/219	Northeast	50–500	25ºC 800mm	2,562.31 ha
Esgario et al. (2009)	Alto Misterioso	170	44/109	Central	850–1143	No information	No information
Couto et al. (2017)	Pedra dos Pontões	211	51/130	South	700–1400	CwB21ºC 1375mm	350 ha
Covre et al. (2021)	Pedra da Andorinha	121	40/96	South	150–500	CwA 1450mm	360 ha

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Table 2.

Comparison of the number of species, genera, and families among the different areas with floristic inventories of vegetation islands on inselbergs in Espirito Santo state.

Rank	This study 2021–23	Covre et al. (2021)	Couto et al. (2017)	Pena and Alves-Araújo (2017)
Species	105	66	87	154
Families	36	27	34	52
Genera	74	55	68	112

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Table 3.

Comparison of species richness of the families on vegetation islands in different areas with floristic inventories of inselbergs in Espirito Santo State. The number of species is in parentheses.

Present study	Covre et al. (2021)	Couto et al. (2017)	Pena and Alves-Araújo (2017)
Bromeliaceae (13)	Bromeliaceae (9)	Orchidaceae(25)	Bromeliaceae(14)
Asteraceae (10)	Fabaceae (7)	Bromeliaceae(8)	Euphorbiaceae(10)
Melastomataceae (8)	Asteraceae (6)	Asteraceae(5)	Fabaceae(8)
Orchidaceae (7)	Orchidaceae (5)	Gesneriaceae, Melastomataceae (4)	Asteraceae, Cactaceae, Cyperaceae, Melastomataceae, Orchidaceae (7)
Araceae (5)	Cactaceae (4)	Begoniaceae, Myrtaceae, Velloziaceae (3)	Apocynaceae, Commelinaceae, Rubiaceae (6)
Apocynaceae (4)	Cyperaceae, Euphorbiaceae, Gesneriaceae, Myrtaceae (3)	Anemiaceae, Apocynaceae, Cactaceae, Cyperaceae, Polypodiaceae, Pteridaceae (2)	Araceae (4)
Bignoniaceae, Cactaceae, Cyperaceae, Dioscoreaceae, Euphorbiaceae, Gesneriaceae, Poaceae (3)	Apocynaceae, Commelinaceae, Dioscoreaceae, Solanaceae, Velloziaceae (2)	20 families (1)	Begoniaceae, Bignoniaceae, Gesneriaceae, Myrtaceae, Phyllanthaceae, Poaceae, Solanaceae (3)
Cannaceae, Fabaceae, Malvaceae, Polygalaceae, Velloziaceae, Verbenaceae (2)	13 families (1)		Acanthaceae, Arecaceae, Cannaceae, Celastraceae, Cleomaceae, Clusiaceae, Malvaceae, Moraceae, Portulacaceae, Talinaceae, Velloziaceae (2)
13 families (1)			22 families (1)

Table 4.

Comparison between previous studies and the present study in the "Monumento Natural dos Pontões Capixabas": richness of genera on vegetation islands. The number of species is in parentheses.

Present study	Covre et al. (2021)	Couto et al. (2017)	Pena and Alves-Araújo (2017)
Pleroma (6)	*Pitcairnia* (4)	*Pitcairnia* (4)	*Borreria* (4)
Anthurium (4)	*Sinningia* (3)	*Begonia*, *Prescottia* (3)	*Begonia*, *Cnidoscolus*, *Dichorisandra*, *Mandevilla*, *Phyllanthus*, *Pleroma*, *Solanum*(3)
Anemia, *Dioscorea*, *Dyckia* , *Selaginella* (3)	*Alcantarea*, *Centrosema*, *Cyperus*, *Dioscorea*, *Macroptilium*, *Vellozia* (2)	*Anemia*, *Baccharis*, *Brasiliorchis*, *Doryopteris*, *Epidendrum*, *Myrcia*, *Octomeria*, *Sinningia*, *Tibouchina*, *Vellozia*, *Vriesea*, *Zygopetalum* (2)	*Acianthera*, *Aechmea*, *Anthurium*, *Bulbostylis*, *Canna*, *Cereus*, *Clidemia*, *Clusia*, *Commelina*, *Cyperus*, *Encholirium*, *Ficus*, *Handroanthus*, *Ichnanthus*, *Marsdenia*, *Pitcairnia*, *Portulaca*, *Rhynchospora*, *Senna*, *Sinningia*, *Stillingia*, *Talinum*, *Tarenaya*, Vellozia (2)
Alcantarea, *Canna*, *Chamaecrista*, *Cheilanthes* , *Clusia*, *Cnidoscolus*, *Cololobus*, *Mandevilla*, *Melinis*, *Merianthera*, *Orthophytum*, *Pitcairnia*, *Pseudolaelia*, *Sinningia*, *Stigmatodon*, *Vellozia* (2)	47 genera (1)	53 genera (1)	81 genera (1)
52 genera (1)			

Table 5.

List of vascular plants in the "Monumento Natural dos Pontões Capixabas" classified in one of threat categories, according to IUCN criteria (VU = Vulnerable, CR = Critically endangered, EN = Endangered), on the Brazilian red list (Ministério do Meio Ambiente 2022) and on the Espírito Santo State's red list (Espírito Santo 2022).

Family	Scientific Name	MMA	ES
Anemiaceae	*Anemia patens* Mickel & Labiak	-	EN
Anemiaceae	*Anemia retroflexa* Brade	-	VU
Arecaceae	*Syagrus ruschiana* (Bondar) Glassman	-	VU
Asteraceae	*Cololobus argenteus* M.Monge & Semir	-	EN
Asteraceae	*Wunderlichia azulensis* Maguire & G.M.Barroso	VU	
Bromeliaceae	*Alcantarea simplicisticha* Leme & A.P.Fontana	-	VU
Bromeliaceae	*Dyckia bracteata* (Wittm.) Mez	-	EN
Bromeliaceae	*Dyckia caudata* (L.B.Sm.)Forzza	-	VU
Bromeliaceae	*Dyckia horrida* (L.B.Sm.) Forzza	EN	VU
Bromeliaceae	*Orthophytum zanonii* Leme	CR	CR
Bromeliaceae	*Pitcairnia barbatostigma* Leme & A.P.Fontana	-	VU
Bromeliaceae	*Pitcairnia decidua* L.B.Sm.	EN	
Bromeliaceae	*Stigmatodon apparicianus* (E. Pereira & Reitz) Leme, G.K.Br. & Barfuss	-	EN
Calophyllaceae	*Kielmeyera rupestris* Duarte	CR	CR
Dilleniaceae	*Davilla hirsuticarpa* Fraga & Aymard	-	VU
Euphorbiaceae	*Cnidoscolus hamosus* Pohl	CR	-
Fabaceae	*Stylosanthes guianensis* (Aubl.) Sw.	VU	-
Gesneriaceae	*Sinningia aghensis* Chautems	-	VU
Malpighiaceae	*Stigmaphyllon crenatum* C.E.Anderson	EN	EN
Malvaceae	*Pseudobombax petropolitanum* A.Robyns	EN	-
Melastomataceae	*Merianthera burlemarxii* Wurdack	EN	EN
Melastomataceae	*Merianthera pulchra* Kuhlm.	VU	VU
Melastomataceae	*Pleroma cucullatum* F.S.Mey., Fraga & R.Goldenb.	-	CR
Melastomataceae	*Pleroma fontanae* F.S.Mey., L.Kollmann & R.Goldenb.	-	CR
Orchidaceae	*Encyclia spiritusanctensis* L.C.Menezes	-	CR
Orchidaceae	*Epidendrum robustum* Cogn.	VU	VU
Orchidaceae	*Pabstiella muricatifolia* Fraga & L.Kollmann	-	EN
Orchidaceae	*Pseudolaelia dutrae* Ruschi	VU	-
Piperaceae	*Peperomia incana* (Haw.) Hook.	-	EN
Poaceae	*Axonopus graniticola* P.L.Viana	-	VU
Rubiaceae	*Bradea brasiliensis* Standl.	EN	-

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Verbenaceae	*Stachytarpheta gesnerioides* Cham.	-	EN

Table 6.

Species described based on type collections from the municipalities of Pancas and Águia Branca, for all vegetation types.

Family	Scientific name	Voucher	Collection Year	Municipality	Publication
Apocynaceae	*Mandevilla grazielae* M.F. Sales, Kin.-Gouv. & A.O. Simões	G.J. Sheperd 5869	1977	Águia Branca	Sales et al. (2006)
Araceae	*Anthurium marcusianum* Théofilo, L.Kollmann & Sakur.	L. Kollmann 10937	2008	Águia Branca	Valadares et al. (2019)
Asteraceae	*Cololobus argenteus* M.Monge & Semir	A.P. Fontana 2330	2006	Águia Branca	Monge et al. 2018
Asteraceae	*Senecio espiritosantensis* A.M.Teles	H. Q. Boudet Fernandes 3457	2007	Águia Branca	Teles (2018)
Asteraceae	*Senecio hortensiae* A.M.Teles	A. P. Fontana 2344	2006	Pancas	Teles and Freitas (2013)
Begoniaceae	*Begonia aguiabrancensis* L.Kollmann	V. Demuner 2286	2006	Águia Branca	Kollmann (2008)
Begoniaceae	*Begonia wasshauseniana* L.Kollmann & A.Peixoto	V. Demuner 3550	2007	Pancas	Kollmann et al. (2012)
Bignoniaceae	*Adenocalymma apetiolatum* L.H.Fonseca & Zuntini	H. Q. Boudet Fernandes 3508	2007	Águia Branca	Fonseca et al. (2016)
Bignoniaceae	*Adenocalymma lineare* L.H.Fonseca & Zuntini	L. F. S. Magnago 1158	2006	Nova Venécia	Fonseca and Lohmann (2019)
Bromeliaceae	*Alcantarea longibracteata* Leme & Fraga	E. Leme 7346	2008	Águia Branca	Versieux (2009)
Bromeliaceae	*Alcantarea simplicisticha* Leme & A.P.Fontana	E. Leme 7355	2008	Águia Branca	Versieux (2009)
Bromeliaceae	*Orthophytum pseudovagans* Leme & L. Kollmann	V. Demuner 2270	2006	Águia Branca	Leme and Kollmann (2007)
Bromeliaceae	*Orthophytum zanonii* Leme	A.P. Fontana 2324	2006	Pancas	Leme (2004)
Bromeliaceae	*Pitcairnia barbatostigma* Leme & A.P.Fontana	A.P. Fontana 2339	2006	Águia Branca	Leme et al. (2010)

Convolvulaceae	*Ipomoea scopulina* J.R.I. Wood & Scotland	D.P. Saraiva 47	2010	Águia Branca	Wood et al. (2017)
Dilleniaceae	*Davilla hirsuticarpa* Fraga & Aymard	L. F. S. Magnago 1149	2006	Pancas	Fraga et al. (2017)
Dioscoreaceae	*Dioscorea medusae* F.Fraga, R.Couto & J.M.A.Braga	F.R.M. Fraga 163	2017	Pancas	Fraga et al. (2019)
Flacourtiaceae	*Casearia souzae* R. Marquete & Mansano	M.C.Souza 610	2008	Águia Branca	Marquete and Freitas Mansano (2010)
Leguminosae	*Senegalia grazielae* M.J.F. Barros & M.P. Morim	V. Demuner 4783	2007	Águia Branca	Barros and Morim (2014)
Melastomataceae	*Merianthera parvifolia* R.Goldenb., Fraga & A.P.Fontana	L. F. S. Magnago 1120	2006	Águia Branca	Goldenberg et al. (2012)
Melastomataceae	*Pleroma marinana* P.J.F.Guim. & Fraga	C.N. Fraga 962	2003	Águia Branca	Fraga and Guimarães (2014)
Melastomataceae	*Pleroma penduliflora* Fraga & P.J.F. Guim.	C.N. Fraga 965	2003	Pancas	Fraga and Guimarães (2014)
Myrtaceae	*Campomanesia sepalifolia* Luber & M. Ibrahim	J. Luber 230	2016	Águia Branca	Luber et al. (2017)
Myrtaceae	*Myrcia cacuminis* L.Kollmann & Sobral	L. F. S. Magnago 1341	2006	Águia Branca	Sobral et al. (2014)
Orchidaceae	*Pabstiella muricatifolia* Fraga & Kollmann	V. Demuner 2246	2006	Águia Branca	Fraga and Kollmann (2010)
Piperaceae	*Peperomia aggregata* E. F. Guim. & Carv.-Silva.	M. Saavedra 684	2008	Águia Branca	Carvalho-Silva et al. (2019)
Rubiaceae	*Ixora emygdioi* Di Maio & Peixoto	Bruno, E.A. 191	1942	Águia Branca	Maio and Peixoto (2012)
Solanaceae	*Solanum filirhachis* Giacomin & Stehmann	V. Demuner 4817	2007	Águia Branca	Knapp et al. (2015)
Violaceae	*Anchietea ballardii* Paula-Souza	D.P. Saraiva 48	2010	Águia Branca	Paula-Souza and Pirani (2016)

Table 7.

Table of new records. VI = Vegetation islands; SLL = Sugarloaf Land; ES = Espírito Santo State; VRO = Vegetation on rocky outcrops. Classification according to Flora e Funga do Brasil (2023).

Species	VI	Scrub	SLL	ES	ROV
Aechmea lingulata		x			x
Aechmea ramosa		x			x
Anchietea ballardii		x			
Baccharis glutinosa				x	
Bougainvillea spectabilis	x		x		x
Bradea brasiliensis	x			x	
Canna paniculata	x		x		x
Cheilanthes regnelliana		x		x	
Dioscorea campestris	x		x		
Erechtites hieracifolius	x		x		x
Herreria salsaparilha				x	x
Ipomoea quamoclit	x		x		x
Koellensteinia florida		x			
Lepidaploa muricata	x		x	x	x
Pecluma plumula		x			x
Pleroma vimineum				x	
Polygala glochidiata	x		x		
Porophyllum ruderale	x		x		x
Stachytarpheta gesnerioides				x	x
Stillingia dichotoma	x			x	
Tabebuia reticulata				x	
Tanaecium selloi		x	x		

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Table 8.

Number of vegetations types, domains, and states of occurrence based on Flora e Funga do Brasil and the number of records in the Reflora and SpeciesLink virtual herbaria for the species listed in Table 7. * = Anthropic area.

Species	Vegetation types	Domain	States	REFLORA Herbarium	SpeciesLink Herbarium
Aechmea lingulata	4	2	8	118	258
Aechmea ramosa	2	1	4	178	240
Anchietea ballardii	2*	1	1	11	10
Baccharis glutinosa	10*	5	10	213	394
Bougainvillea spectabilis	4	4	12	490	1046
Bradea brasiliensis	1	1	1	75	96
Canna paniculata	5*	4	15	267	491
Cheilanthes regnelliana	3	1	2	28	51
Dioscorea campestris	7	4	20	299	527
Erechtites hieracifolius	5	6	24	176	1589
Herreria salsaparilha	3	3	7	186	355
Ipomoea quamoclit	6*	5	25	252	628
Koellensteinia florida	1	1	2	87	114
Lepidaploa muricata	1	1	3	62	136
Pecluma plumula	2	1	11	252	857
Pleroma vimineum	2	1	1	49	19
Polygala glochidiata	4	3	18	400	642
Porophyllum ruderale	1*	6	26	661	2152
Stachytarpheta gesnerioides	3	1	7	209	297
Stillingia dichotoma	3	1	1	58	68
Tabebuia reticulata	1	1	1	26	39
Tanaecium selloi	6	5	15	484	890

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Supplementary materials

Suppl. material 1: Checklist of Rupicolous Vascular Plant Species in MONAPC *sensu stricto*

Authors: Arantes, F.M.
Data type: Checklist
Brief description: Checklist of Rupicolous Vascular Plant Species in MONAPC (Monumento Natural dos Pontões Capixabas) *sensu stricto*, Espírito Santo State, Brazil. It contains 105 species occurring on lowland inselbergs and highlights species included in official lists of endangered flora. Taxonomy, Life Form, Substrate, Vegetation Type, Occurrence Brazil and Domain according to Flora e Funga do Brasil (2023).
Download file (21.58 kb)

Suppl. material 2: Checklist of Rupicolous Vascular Plant Species in MONAPC *sensu lato*

Authors: Arantes, F.M.
Data type: Checklist
Brief description: Checklist of Rupicolous Vascular Plant Species in the Monumento Natural dos Pontões Capixabas *sensu lato*, Espírito Santo State, Brazil. It contains 206 species occurring on lowland inselbergs and highlights species included in official lists of endangered flora. Taxonomy, Life Form, Substrate, Vegetation Type, Occurrence Brazil and Domain according Flora e Funga do Brasil (2023).
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