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Inventory

Current knowledge of ferns and lycophytes in Sergipe state, northeastern Brazil

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Abstract: Brazil has one of the greatest diversity of ferns and lycophytes in the world, especially in its humid forests. The knowledge about these plants in the 27 federative units is uneven and can potentially hamper conservation actions aimed at them. In the state of Sergipe, collections of these groups have been sporadic and about 50 species have been cataloged so far, a low number when compared to other states. This study aimed to compile the species of ferns and lycophytes occurring in Sergipe based on herbaria materials and recent samples collected. Therefore, specimens from herbaria were accessed, together with online databases, as well as 13 botanical expeditions were carried out in three areas. Our study recorded of 20 families, 44 genera and 86 species (75 ferns and 11 lycophytes), with eight new records for the state. The most representative families were Pteridaceae (21 spp.), Polypodiaceae (12), Anemiaceae (nine) and Selaginellaceae (eight). The genera *Adiantum* L. (eight spp.), *Anemia* Sw. (nine spp.) and *Selaginella* P.Beauv. (eight spp.) had the highest number of species. The study shows that efforts like these are extremely necessary and may eventually indicate the extent to which the richness of ferns and lycophytes in Sergipe is underestimated, also promoting researches in this area of Botany.
Keywords: *Atlantic forest; Checklist; New records; Seedless vascular plants.*

Conhecimento atual das samambaias e licófitas no estado de Sergipe, nordeste do Brasil

Resumo: O Brasil possui uma das maiores diversidades de samambaias e licófitas do mundo, principalmente em florestas úmidas. No entanto, o conhecimento sobre essas plantas nas 27 unidades federativas é desigual e isso pode dificultar as ações de conservação voltadas para elas. No estado de Sergipe, as coletas desses grupos têm sido esporádicas e cerca de 50 espécies foram catalogadas até o momento, um número baixo quando comparado a outros estados. Este estudo teve como objetivo compilar as espécies de samambaias e licófitas ocorrentes em Sergipe a partir de materiais de herbários e amostragens recentes. Para tanto, foram acessados espécimes em herbários, juntamente com bancos de dados on-line, bem como 13 expedições botânicas foram realizadas em três áreas. Nosso estudo registrou 20 famílias, 44 gêneros e 86 espécies (75 de samambaias e 11 de licófitas), com oito novos registros para o Estado. As famílias mais representativas foram Pteridaceae (21 spp.), Polypodiaceae (12), Anemiaceae (oito) e Selaginellaceae (oito). Os gêneros *Adiantum* L. (oito spp.), *Anemia* Sw. (nove spp.) e *Selaginella* P.Beauv. (oito spp.) apresentaram o maior número de espécies. O estudo mostra que esforços como esses são extremamente necessários e podem eventualmente indicar o quanto a riqueza de samambaias e licófitas em Sergipe está subestimada, promovendo também pesquisas nessa área da Botânica.
Palavras-chave: *Checklist; Floresta Atlântica; Novos registros; Plantas vasculares sem sementes.*

Introduction

Brazil is considered the home of one of the most diverse flora in the world (Giulietti et al. 2005), particularly of ferns and lycophytes, that is, seedless vascular plants (PPG I 2016), with about 1411 taxa currently known in the country (Flora e Funga do Brasil 2023), harboring a center of Neotropical diversity of groups (Suissa & Sundue 2020). There are representatives of these two plant lineages in all Brazilian phytogeographic domains, but humid forests stand out in terms of richness – about 70% of the species are recorded in the Atlantic Forest (Salino & Almeida 2009). Despite the high number of taxa cataloged, the knowledge about these plants differs considerably among the 27 federative units and the regions of Brazil (see Prado & Sylvestre 2010, Prado et al. 2015, Santiago et al. 2023); this may hamper the conservation actions aimed at them (Oliveira et al. 2017).

The state of Sergipe has the smallest territory in the country and one of the least known fern and lycophyte flora (Santiago 2006, Andrade et al. 2022). Floristic collections on these groups in Sergipe began around 1962 when botanist Dárdano de Andrade-Lima collected *Anemia oblongifolia* (Cav.) Sw. (see CRIA 2023). Subsequentely, there was a concentration of collections in the state between 1980 and 1984, totaling approximately 76 records, with notable collectors such as Gilvane Viana de Souza and Marcelo Ramos da Fonseca (see GBIF-Global Biodiversity Information Facility 2024). In the following years, no systematic or intensified period of collection for these groups was observed, and the records became sporadic, with several years passing without any records or with fewer than eight (GBIF 2024).

However, based on systematic collections in the Caatinga, Xavier et al. (2007) reported eight new records for the state. Subsequent contributions to floristic knowledge were made through the project 'Flora de Sergipe,' published in two volumes: 'Flora de Sergipe, Vol. 1' (Prata et al. 2013) and 'Flora de Sergipe, Vol. 2' (Prata et al. 2015). This project included studies on several families that had records in botanical collections. However, only two fern families were monographed: Blechnaceae (Santiago et al. 2015) and Gleicheniaceae (Santiago 2015), with three and one species, respectively. Interestingly, two taxa with wide distribution in Brazil were considered new records for Sergipe – *Neoblechnum brasiliense* (Desv.) Gasper & V.A.O. Dittrich and *Telmatoblechnum serrulatum* (Rich.) Perrie, D.J. Ohlsen & Brownsey, both widely recorded in the Atlantic Forest (see Santiago et al. 2015), revealing the profound lack of knowledge about the fern and lycophyte flora of the state.

Floristic inventories focused on angiosperms carried out in the last years in the state of Sergipe have recorded also some fern and lycophyte species. Oliveira et al. (2014) carried out a study in the restingas of Sergipe and cataloged nine species of ferns. Oliveira et al. (2016) carried out a botanical survey for plants in the Atlantic Forest remnant of Mata do Junco Wildlife Refuge and cataloged five species of ferns and lycophytes; Santana et al. (2017) listed three species in a survey for Ibura National Forest; Araújo et al. (2019) provided a list of vascular epiphytes and recorded nine species; Silva et al. (2019) presented a checklist of vascular plants and recorded 24 species – these last works were carried out in the Atlantic Forest remnants in Serra de Itabaiana National Park. Recently, Andrade et al. (2022) revisited the flora of ferns in the Mata do Junco Wildlife Refuge and recorded 23 species.

Currently, around 50 to 70 species of ferns and lycophytes are recorded for Sergipe (Flora e Funga do Brasil 2023; Santiago et al. 2023). This number is comparatively low when compared to other states in Brazil, with Sergipe ranking among the lowest in species richness (Flora e Funga do Brasil 2023). This may be explained by the small sampling effort (Santiago 2013), since most of the research carried out in the state is directed to other groups of plants (e.g. Ferreira et al. 2013, Prata et al. 2013, Landim et al. 2015, Prata et al. 2015). Furthermore, depending on the methodology used in floristic studies, species of ferns and lycophytes may go unnoticed. For example, among the 530 plant species recorded in the National Forest Inventory in Sergipe, there is only one species of fern (*Anemia dentata* Gardner) (Serviço Florestal Brasileiro – SFB 2017).

Floristic surveys provide fundamental information about the composition of the flora of a given area. They also contribute to the construction of databases for the elaboration of further works in the areas of taxonomy, ecology, geographic distribution, and conservation (Pereira et al. 2011, Silva et al. 2019). Studies on ferns and lycophytes from Sergipe are very few, generating a gap both in the Atlantic Forest and in the Caatinga, being more pronounced in the latter. Therefore, it is believed that domains and phytofisionomies in the Sergipe have underestimated diversity of ferns and lycophytes. In this scenario, the definition of strategies aimed at filling gaps in floristic knowledge of ferns and lycophytes should consider compiling scarce and fragmented information, in order to obtain a spatial panorama on a large scale of collections, as well as areas with greater potential for diversity to be prioritized in relation to collection efforts. Thus, the present work aimed to compile the species of ferns and lycophytes occurring in the state of Sergipe based on herbaria materials, online databases and recent samplings, proving a list of species.

Material and Methods

1. Study area

The state of Sergipe is geographically located in the Northeast region of Brazil, between the coordinates 9°31' – 11°34' S & 36°25' – 38°14' W. It has an approximate area of 21,910 km^2, the smallest state in the country. It is limited to the north by the state of Alagoas, to the south and west by the state of Bahia and to the east by the Atlantic Ocean (Figure 1). The climate is divided between tropical hot and humid (As) and semi-arid (Bsh). The climate "AS" is predominant in the eastern portion of the state and in the *Zona da Mata*, under the influence of the ocean, and is characterized by showing rainfall from autumn to winter, an annual average close to 1200 mm, a short dry period (two months), temperatures higher than at 20ºC, and low thermal amplitude. The climate "Bsh" occurs predominantly in areas located farther from the coast of the state, such as the *agreste* and *sertão* regions, being characterized by having an average annual rainfall of up to 800 mm, a long dry period (up to eight months), and high temperatures (Santos et al. 2023). The relief is very heterogeneous, with altitudes reaching 300 m in some areas, and 400 m and 750 m in others [e.g. in the complex of residual mountain ranges present in the Agreste (a transition region between Atlantic Forest and Caatinga) and hinterland of the state] (França & Cruz 2013). Regarding soil types, planosol Sodic Eutrophic and podzolic yellow red are predominantly in the Caatinga area. In the Atlantic Forest region, it can be found

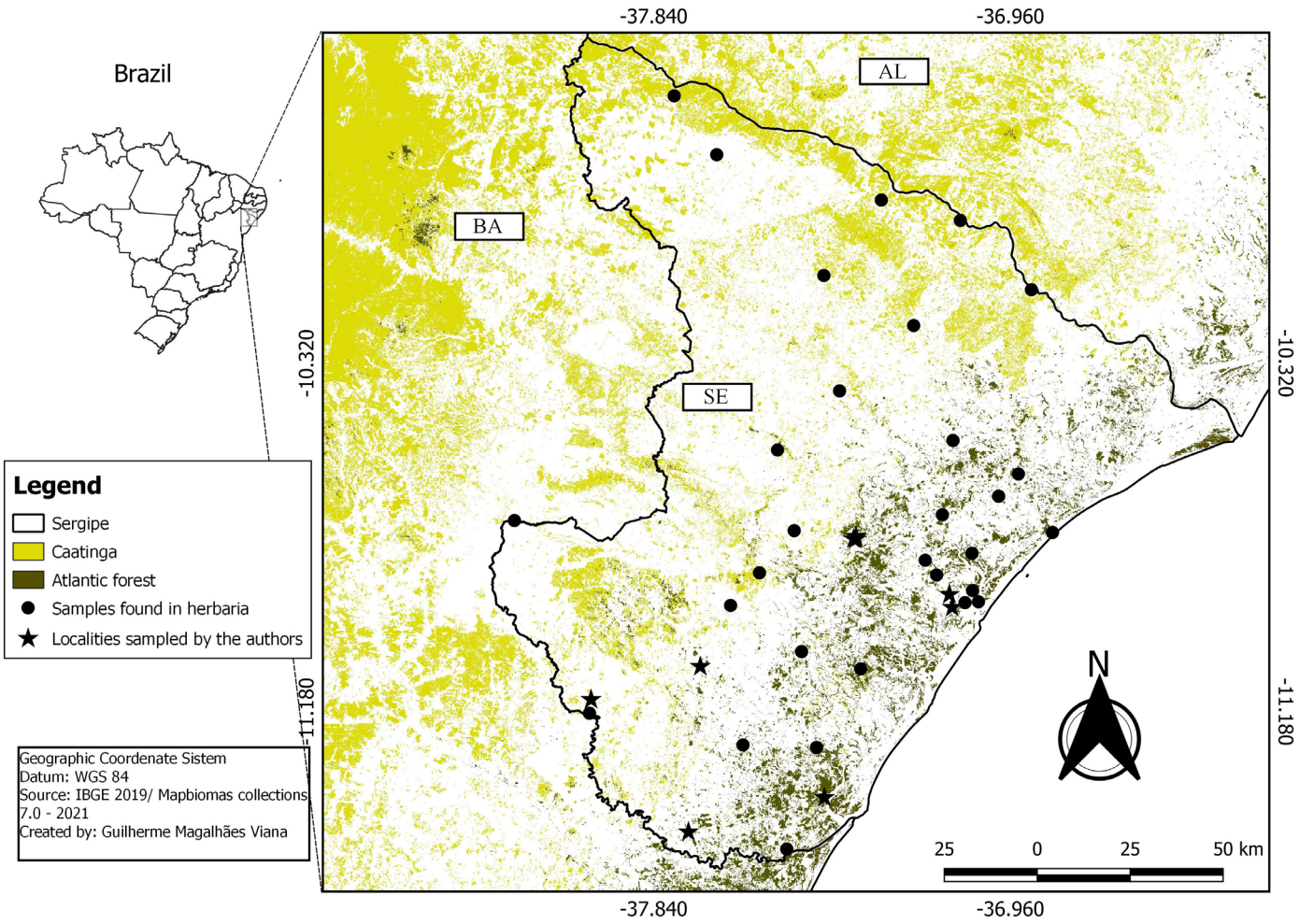

Figure 1. Map of the region and vegetation of the state of Sergipe, highlighting samples analyzed.

soils of the red yellow podzolic, dystrophic red yellow latosol, and planosol sodic eutrophic types (Jacomine et al. 1975).

The vegetation in the state of Sergipe consists of remnants of two phytogeographic domains, Caatinga and Atlantic Forest (Figure 2). The latter predominates in the coastal region, where the main urban centers are located, and consists of different phytophysiognomies, including seasonal forests, mangroves and sandbanks. The transition zone between the Atlantic Forest and Caatinga is known as the Agreste region and presents intermediate climatic and floristic characteristics. Caatinga vegetation predominates in the hinterland of Sergipe, often interspersed with pastures and temporary crops (Farias 2013, França & Cruz 2013). A small portion of the territory of Sergipe (5%) is protected within federal, state, municipal and private reserves, which amount to 23 Conservation Units; 47% of the area encompassed within these Conservation Unites corresponds to forests dry and wet, indicating an attempt to conserve the forest cover of the state, which corresponds to almost 13% of its territory (SFB 2017).

2. *Data collection and analysis*

The data for this study were obtained from the analysis of herbaria specimens *in loco* (ASE and UFP – acronyms according to Thiers [continuously updated]) and from databases available online, such as *species*Link (CRIA 2023), Reflora – Virtual Herbarium (2023), GBIF (GBIF 2024) and Flora e Funga do Brasil (2023). After searching online databases, records of ferns and lycophytes were retrieved from the following collections: ASE, ALCB, HUEFS, JPB, MAC, MBM, RB, RN, UFP and UPCB. Regarding the species observed through online databases, only records with identification confirmed by specialists and/or with verified digitized images were considered.

Furthermore, thirteen field trips to the main Atlantic Forest remnants in Sergipe were carried out between the years 2020 and 2022 in the municipalities of Areia Branca (Serra de Itabaiana National Park – PARNASI); Capela (Mata do Junco Wildlife Refuge – RVS); and Santa Luzia do Itanhy (Mata do Crasto Private Heritage Reserve – RPPN) (Figure 1). The floristic survey consisted of walking through preferred environmental of these plants, such as humid sites and/or proximity to riverbanks, rocks, and ravines (Filgueiras 1992; Pereira et al. 2013).

The collected samples were herborized according to the usual techniques (Windisch 1992) and then identified and deposited in the ASE herbarium. The sample analysis process was carried out with the aid of taxonomic revisions and Brazilian regional floras. The classification system adopted for the sequence of presentation of families and genera followed the "Pteridophyte Phylogeny Group"

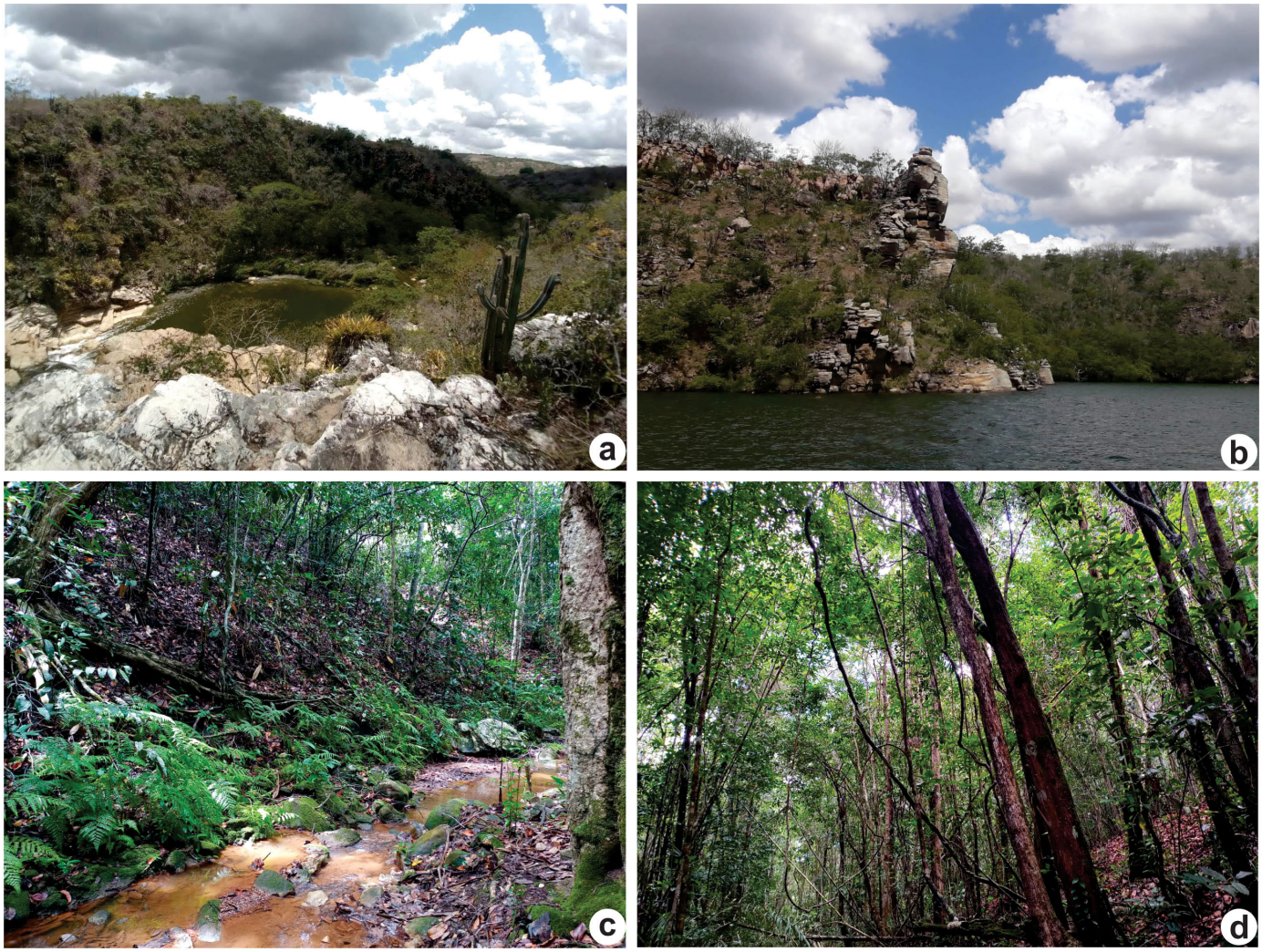

Figure 2. a-d. The vegetation in the state of Sergipe, Brazil – a. Serra da Miaba, municipality of Macambira (Caatinga); b. Municipality of Canindé de São Francisco (Caatinga); c-d. Serra of Itabaiana National Park, municipality of Areia Branca (Atlantic Forest).

(PPG I 2016). Nomenclatural data for scientific names and geographical distribution were consulted from the Flora e Funga do Brasil (2023). The Categories of threats to species were applied following the guidelines of the National Center for Flora Conservation (CNCFlora, 2023), which include the following categories: deficient data, least concern, not evaluated, and vulnerable. Species substrate information (aquatic, corticicolous, terricolous, rupicolous) is in accordance with Santiago et al. (2004) and Pereira et al. (2013).

Results and Discussion

The current compilation of the flora of ferns and lycophytes of the state of Sergipe showed the occurrence of 20 families, 44 genera and 86 species (75 ferns and 11 lycophytes, Table 1). Of these, the authors collected 43 species; while 43 are from samples deposited in herbaria. With the present study, the total number of species registered for Sergipe is increased in relation to the list provided in Flora e Funga do Brasil (2023), since only 50 species are recorded for Sergipe in this database. However, this number is still half of those registered for nearby states in northeastern Brazil, such as Pernambuco (243 spp.) and Alagoas (146 spp.) (Flora e Funga do Brasil 2023). This demonstrates how the diversity of ferns and lycophytes in the state can be underestimated, as well as the importance of checklists and floristic surveys of these two groups to fill knowledge gaps in this regard.

The families with higher number of species were Pteridaceae (21 spp.), Polypodiaceae (12 spp.), Anemiaceae (nine spp.) and Selaginellaceae (eight spp.). According to Prado & Sylvestre (2010) and Prado et al. (2015), these are the richest families in Brazil. Furthermore, they have been cited among the most representative in floristic inventories carried out in other Brazilian states (e.g. Prado & Hirai 2011, Prado et al. 2017, Lehn et al. 2018). The most representative genera were *Adiantum* L. (eight spp.), *Anemia* Sw. (nine spp.) and *Selaginella* P.Beauv. (eight spp.). Seven species (*Anemia* sp. 1, *Anemia* sp. 2, *Adiantum* sp., *Phlegmariurus* sp., *Selaginella* sp. 1, *Selaginella* sp. 2 and *Selaginella* sp. 3) they were identified only at the genus level due to doubts about the taxonomy of their species.

Of the species recorded in the present study, eight are reported for the first time in Sergipe – are considered those with no records in various

Table 1. Species of ferns and lycophytes recorded for the state of Sergipe, Brazil, distribution across phytogeography domains, habit, and vouchers. CAA = Caatinga. AF = Atlantic Forest. *Species collected by the authors. **New occurrences for Sergipe are considered those with no records in various databases (Flora e Funga do Brasil, GBIF and *species*Link) and specialized literature. ***New records for the State collected by the authors.

Group/family	Species	Phytogeography domains	Substrate	Voucher
Lycophytes				
Lycopodiaceae	*Palhinhaea cernua* (L.) Franco & Vasc.	AF	Terricolous	*A.B. Sales 17* (ASE)
	**Pseudolycopodiella meridionalis* (Underw. & Loyd) Holub	AF	Terricolous	*A.P. Prata 2671* (ASE)
	Phlegmariurus sp.	AF	Corticicolous	*G.S. Garcia 672* (RN)
Selaginellaceae	*Selaginella convolut*a (Arn.) Spring	CAA	Rupicolous	*G. Viana 1446* (ASE)
	****Selaginella muscosa* Spring	AF	Terricolous/ Rupicolous	*A. Santiago 1322* (ASE)
	Selaginella pellucidopunctata Valdespino	AF	Terricolous/ Rupicolous	*P. Gomes 798* (UFP)
	Selaginella simplex Baker	AF	Terricolous	*K. Mendes 155* (UFP)
	Selaginella sulcata (Desv. ex Poir.) Spring	AF	Terricolous	*G. Viana 627* (ASE)
	**Selaginella* sp. 1	AF	Rupicolous	*M.F.B. Andrade 84* (ASE)
	**Selaginella* sp. 2	AF	Rupicolous	*M.F.B. Andrade 86* (ASE)
	**Selaginella* sp. 3	AF	Rupicolous	*M.F.B. Andrade 89* (ASE)
Ferns				
Anemiaceae	*Anemia dentata* Gardner	CAA	Terricolous	*R.M. Déda 321* (ASE)
	Anemia ferruginea Humb. & Bonpl. ex Kunth var. *ferruginea*	AF	Terricolous	*D. Araújo 101* (UFP)
	Anemia hirsuta (L.) Sw.	AF	Terricolous	*L.M.S. Melo 24* (ASE)
	Anemia humilis (Cav.) Sw.	AF	Terricolous	*M. Landim* (RB)
	Anemia oblongifolia (Cav.) Sw.	AF and CAA	Terricolous/ Rupicolous	*E.M. Carneiro 388* (ASE)
	Anemia phyllitidis (L.) Sw.	AF	Terricolous	*M.N. Almeida 89* (ASE)
	Anemia tomentosa (Sav.) Sw.	AF and CAA	Terricolous	*G. Viana 1584* (ASE)
	Anemia sp. 1	AF	Terricolous	*G. Viana 513* (ASE)
	Anemia sp. 2	AF	Terricolous	*F.O. Silva 96* (ASE)
Aspleniaceae	*Asplenium cristatum* Lam.	AF	Terricolous	*F.O. Silva 277* (ASE)
	Asplenium pumilum Sw.	CAA	Rupicolous	*G. Viana* (ASE 2536)
Blechnaceae	**Blechnum occidentale* L.	AF	Terricolous	*M.F.B. Andrade 49* (ASE)
	**Neoblechnum brasiliense* (Desv.) Gasper & V.A.O. Dittrich	AF	Terricolous	*M.F.B. Andrade 54* (ASE)
	**Salpichlaena volubilis* (Kaulf.) J.Sm.	AF	Terricolous	*M.F.B. Andrade 51* (ASE)
	**Telmatoblechnum serrulatum* (Rich.) Perrie, D.J. Ohlsen & Brownsey	AF	Terricolous	*M.F.B. Andrade 41* (ASE)
Cyatheaceae	**Cyathea microdonta* (Desv.) Domin	AF	Terricolous	*M.F.B. Andrade 57* (ASE)
	**Cyathea phalerata* Mart.	AF	Terricolous	*M.F.B. Andrade 55* (ASE)
Dennstaedtiaceae	*Pteridium caudatum* (L.) Maxon	AF	Terricolous	*J. Nascimento 1083* (ASE)
	Pteridium esculentum (G. Forst.) Cockayne	AF	Terricolous	*D.O. Reis 11* (ASE)
Dryopteridaceae	***Olfersia cervina* (L.) Kunze	AF	Rupicolous	*A. Santiago 1328* (ASE)
Gleicheniaceae	**Dicranopteris flexuosa* (Schrad.) Underw.	AF	Terricolous	*A. Santiago 1317* (ASE)
Hymenophyllaceae	**Trichomanes cristatum* Kaulf.	AF	Rupicolous	*M.F.B. Andrade 88* (ASE)
	**Trichomanes pinnatum* Hedw.	AF	Rupicolous	*M.F.B. Andrade 83* (ASE)
Lindsaeaceae	*Lindsaea divaricata* Klotzsch	AF	Terricolous	*L.A.S. Santos 72* (ASE)
	**Lindsaea lancea* (L.) Bedd.	AF	Terricolous	*A. Santiago 1321* (ASE)
	**Lindsaea stricta* (Sw.) Dryand.	AF	Terricolous	*M.F.B. Andrade 87* (ASE)
Lygodiaceae	**Lygodium venustum* Sw.	AF and CAA	Terricolous	*M.F.B. Andrade 42* (ASE)
	**Lygodium volubile* Sw.	AF and CAA	Terricolous	*M.F.B. Andrade 43* (ASE)
Marsileaceae	*Marsilea deflexa* A.Braun	CAA	Aquatic	*E.M. Carneiro 680* (ASE)

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Group/family	Species	Phytogeography domains	Substrate	Voucher
Nephrolepidaceae	**Nephrolepis biserrata* (Sw.) Schott	AF	Rupicolous/ Corticicolous	*M.F.B. Andrade 80* (ASE)
Polypodiaceae	*Campyloneurum nitidum* (Kaulf.) C.Presl	AF	Terricolous	*J.L. Santos 16* (ASE)
	Campyloneurum repens (Aubl.) C.Presl	AF	Rupicolous	*M. Landim 1035* (ASE)
	**Cochlidium serrulatum* (Sw.) L.E.Bishop	AF	Rupicolous	*M.F.B. Andrade 96* (ASE)
	Microgramma crispata (Fée) R.M.Tryon & A.F.Tryon	AF	Corticicolous	*G. Viana 1762* (ASE)
	**Microgramma vacciniifolia* (Langsd. & Fisch.) Copel.	AF and CAA	Corticicolous	*M.F.B. Andrade 74* (ASE)
	**Phlebodium decumanum* (Willd.) J.Sm.	AF	Corticicolous	*M.F.B. Andrade 73* (ASE)
	***Pecluma plumula* (Willd.) M.G.Price	CAA	Corticicolous	*E.V.S. Oliveira 528* (ASE)
	**Pleopeltis astrolepis* (Liebm.) E.Fourn.	AF and CAA	Corticicolous	*M.F.B. Andrade 76* (ASE)
	***Pleopeltis burchellii* (Baker) Hickey & Sprunt ex A.R.Sm.	CAA	Corticicolous	*G. Viana 1447* (ASE)
	**Pleopeltis gyroflexa* (Christ) Schwartsb.	AF and CAA	Corticicolous	*M.F.B. Andrade 48* (ASE)
	Pleopeltis macrocarpa (Bory ex Willd.) Kaulf.	AF	Corticicolous	*J.L. Santos 33* (ASE)
	**Serpocaulon triseriale* (Sw.) A.R.Sm.	AF	Corticicolous/ Terricolous	*M.F.B. Andrade 72* (ASE)
Psilotaceae	*Psilotum nudum* (L.) P.Beauv.	AF	Corticicolous	*S.M. Costa 435* (ASE)
Pteridaceae	**Acrostichum aureum* L.	AF and CAA	Terricolous	*M.F.B. Andrade 37* (ASE)
	Acrostichum danaeifolium Langsd. & Fish.	CAA	Terricolous	*M.S. Leite 84* (UFP)
	**Adiantum deflectens* Mart.	AF and CAA	Terricolous/ Rupicolous	*M.F.B. Andrade 50* (ASE)
	**Adiantum dolosum* Kunze	AF	Terricolous	*M.F.B. Andrade 46* (ASE)
	**Adiantum petiolatum* Desv.	AF	Terricolous	*M.F.B. Andrade 70* (ASE)
	**Adiantum pulverulentum* L.	AF	Terricolous	*M.F.B. Andrade 44* (ASE)
	**Adiantum serratodentatum* Willd.	AF	Terricolous	*M.F.B. Andrade 56* (ASE)
	**Adiantum terminatum* Kunze ex Miq.	AF	Terricolous	*M.F.B. Andrade 33* (ASE)
	**Adiantum tetraphyllum* Willd.	AF	Terricolous	*M.F.B. Andrade 69* (ASE)
	**Adiantum* sp.	AF	Terricolous	*M.F.B. Andrade 45* (ASE)
	Ananthacorus angustifolius (Sw.) Underw. & Maxon	AF	Corticicolous	*B.C.S Lima 153* (ASE)
	Ceratopteris thalictroides (L.) Brongn.	AF	Aquatic	*C.R.P. Franco* (ASE 21657)
	*Doryopteris concolo*r (Langsd. & Fisch.) Kuhn & Decken	CAA	Terricolous	*G. Viana 1995* (ASE)
	Doryopteris pentagona Pic. Serm.	CAA	Terricolous	*S. Schmidt 179* (UFP)
	***Doryopteris sagittifolia* (Raddi) J.Sm.	AF	Terricolous	*G.M.A. Matos 329* (ASE)
	Hecistopteris pumila (Spreng.) J.Sm.	AF	Corticicolous	*F.C. Straube 01* (HUEFS)
	Hemionitis palmata L.	AF and CAA	Terricolous	*M.C.V. Farias 385* (ASE)
	Hemionitis tomentosa (Lam.) Raddi	CAA	Terricolous	*C.L. Souza 24* (ASE)
	**Pityrogramma calomelanos* (L.) Link	AF	Terricolous	*M.F.B. Andrade 60* (ASE)
	**Pteris vittata* L.	AF	Terricolous	*M.F.B. Andrade 01* (ASE)
	**Vittaria lineata* (L.) Sm.	AF	Corticicolous	*A. Santiago 1320* (ASE)
Salviniaceae	*Azolla filiculoides* Lam.	AF and CAA	Aquatic	*T.S. Almeida 15* (ASE)
	Azolla microphylla Kaulf.	CAA	Aquatic	*M.D. Souza* (ASE 2788)
	**Salvinia auriculata* Aubl.	AF and CAA	Aquatic	*M.F.B. Andrade 67* (ASE)
	Salvinia oblongifolia Mart.	AF and CAA	Aquatic	*M.D. Souza* (ASE 2835)
Schizaeaceae	*Actinostachys pennula* (Sw.) Hook.	AF	Terricolous	*G. Hatschbach* (MBM 283802)
	****Schizaea elegans* (Vahl) Sw.	AF	Terricolous	*M.F.B. Andrade 95* (ASE)

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Group/family	Species	Phytogeography domains	Substrate	Voucher
Thelypteridaceae	******Christella dentata*** (Forssk.) Brownsey & Jermy	AF	Terricolous	*M.F.B. Andrade 92* (ASE)
	**Cyclosorus interruptus* (Willd.) H. Ito	AF	Terricolous	*M.F.B. Andrade 58* (ASE)
	**Meniscium arborescens* Humb. & Bonpl. ex Willd.	AF	Terricolous	*A. Santiago 1311* (ASE)
	**Meniscium chrysodioides* Fée	AF	Terricolous	*A. Santiago 1330* (ASE)
	Meniscium serratum Cav.	AF	Terricolous	*G.M.A. Matos 509* (ASE)

Table 2. Conservation units in the state of Sergipe with forest area, phytogeographic domain, number of specimens and species. X absence of records.

Conservation units	Phytogeographical domain	Forest area (ha)	Number of specimens	Number of species
Private Natural Heritage Reserve Bom Jardim	Atlantic Forest	166,87	X	X
Caju Private Natural Heritage Reserve	Atlantic Forest	762,35	X	X
Campos Novos Private Natural Heritage Reserve	Caatinga	102,77	X	X
Dona Benta e Seu Caboclo Private Natural Heritage Reserve	Atlantic Forest	24,07	X	X
Grota do Angico Natural Monument	Caatinga	2.103	8	1
Ibura National Forest	Atlantic Forest	144,18	5	4
Lagoa do Frio Municipal Natural Park	Caatinga	277,21	X	X
Mata do Cipó Area of Relevant Ecological Interest	Atlantic Forest	59,70	2	2
Mata do Junco Wildlife Refuge	Atlantic Forest	894,90	35	23
Morro do Urubu Environmental Protection Area	Atlantic Forest	215,65	X	X
Litoral Norte Environmental Protection Area	Atlantic Forest	46.145	X	X
Pedra da Urça Private Natural Heritage Reserve	Atlantic Forest	30,91	X	X
Poxim Municipal Natural Park	Atlantic Forest	173,20	X	X
Natural Marinheiro Private Heritage Reserve	Atlantic Forest	145,19	X	X
Private Natural Heritage Reserve Lagoa Encantada da Lucrécia	Atlantic Forest	10,73	X	X
Pirangy Private Natural Heritage Reserve	Atlantic Forest	13,59	X	X
São Francisco River Natural Monument	Caatinga	7.017,06	X	X
Santa Isabel Biological Reserve	Atlantic Forest	4.782,37	X	X
Serra de Itabaiana National Park	Atlantic Forest	7.999,11	91	44
Fonte da Bica Private Natural Heritage Reserve	Atlantic Forest	13,07	X	X
Litoral Sul Environmental Protection Area	Atlantic Forest	48.095,17	X	X
Tapera Private Natural Heritage Reserve	Atlantic Forest	130,60	X	X
Tramandaí Ecological Municipal Park	Atlantic Forest	4,10	X	X

databases and some scientific articles (See Oliveira et al. 2014, Silva et al. 2019, Flora e Funga do Brasil and *species*Link). Of these, six are ferns – *Christella dentata* (Forssk.) Brownsey & Jermy, *Doryopteris sagittifolia* (Raddi) J.Sm., *Olfersia cervina* (L.) Kunze, *Pecluma plumula* (Willd.) M.G.Price, *Pleopeltis burchellii* (Baker) Hickey & Sprunt ex A.R.Sm. *Schizaea elegans* (Vahl) Sw. – and two are lycophytes – *Pseudolycopodiella meridionalis* (Underw. & Loyd) Holub and *Selaginella muscosa* Spring. It is important to emphasize that only *C. dentata*, *S. muscosa* and *S. elegans* were collected by the authors, the other species were misidentified in the herbaria and/or determined up to the genus status.

The species *Pecluma plumula* and *Selaginella pellucidopunctata* have a more restricted distribution in the Northeast compared to all other taxa cataloged in this study (see CRIA 2023, Flora e Funga do Brasil 2023). The first species, *P. plumula*, has a record of occurrence in the Northeast only in the states of Alagoas, Ceará, Bahia and Pernambuco – in a few municipalities (*species*Link 2023). The last, *S. pellucidopunctata*, is endemic to Northeast Brazil and its occurrence was until now restricted to the states of Alagoas, Bahia and Pernambuco (see Valdespino 2015, Flora e Funga do Brasil 2023, CRIA 2023). This type of information is important for knowing the entire distribution of species and consequently allows precise geographic inferences, such as geographic mapping of phylogenetic diversity, ecological niche modeling, identification of areas of endemism and assessments of conservation status (Almeida & Salino 2016).

Of the total fern and lycophyte species reported in this study for Sergipe about 72% (62 spp.) occur exclusively in the Atlantic Forest (Table 1). This domain favors ideal conditions for the establishment of taxa, such as a humid and shady environment, comparatively with the Caatinga (Xavier & Barros 2005). Furthermore, Atlantic Forest is inserted in places that have more concentrations of collections

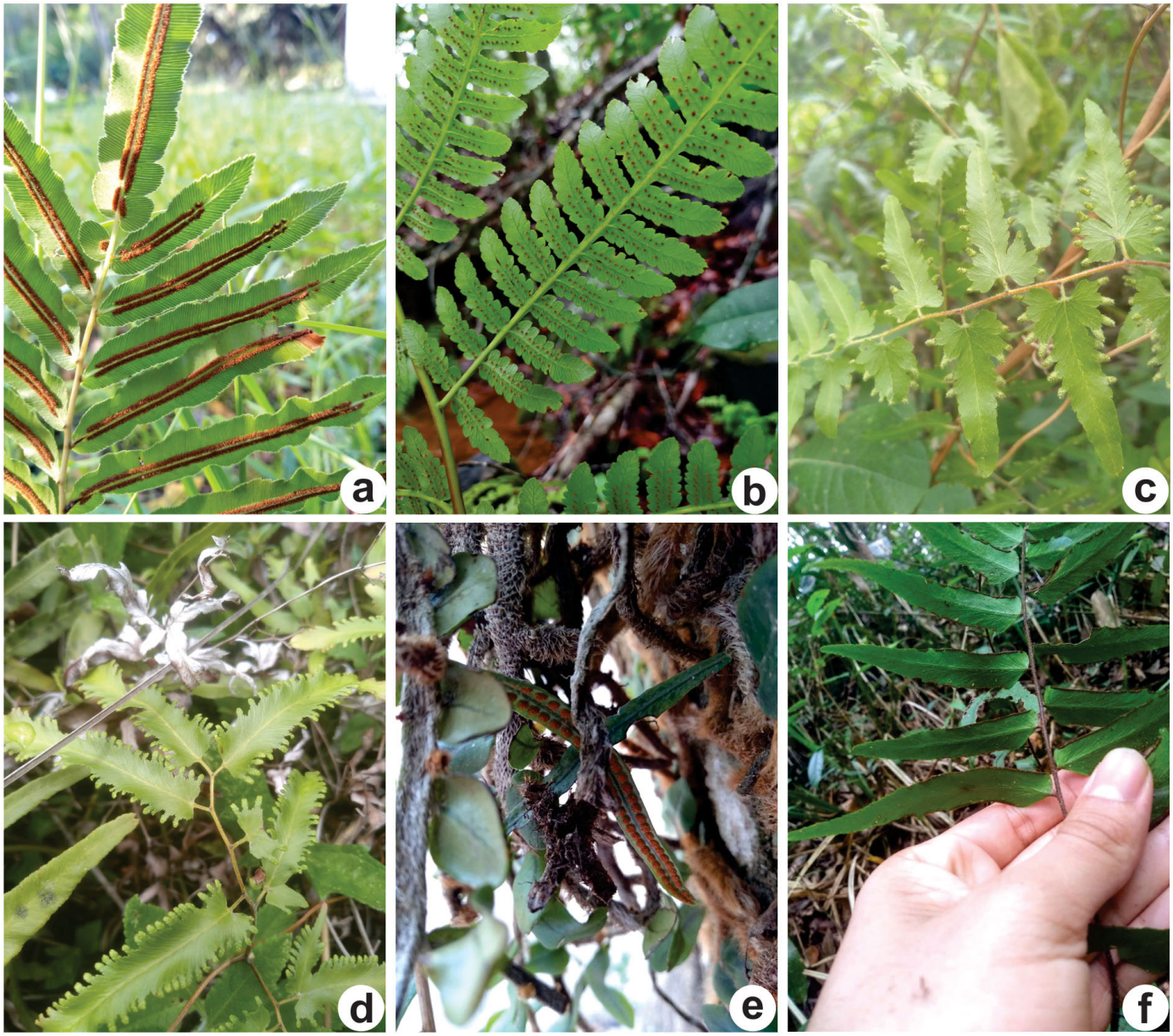

Figure 3. a-f. Some species recorded from of Sergipe state, Brazil. a. *Telmatoblechnum serrulatum* (Blechnaceae); b. *Cyathea microdonta* (Cyatheaceae); c. *Lygodium venustum* (Lygodiaceae); d. *Lygodium volubile* (Lygodiaceae); e. *Microgramma vacciniifolia* (Polypodiaceae); f. *Adiantum dolosum* (Pteridaceae).

(e.g. PARNASI and Mata do Junco Wildlife Refuge). To a lesser proportion, 13% (11 spp.) were registered exclusively in the Caatinga of the state [e.g. *Adiantum deflectens* Mart., *Anemia oblongifolia* (Cav.) Sw., *Doryopteris concolor* (Langsd. & Fisch.) Kuhn & Decken and *Selaginella convoluta* (Arn.) Spring] and these data corroborate Xavier et al. (2012), who cited these taxa as tolerant to the more xeric environments of the Caatinga. With the exception of *Adiantum deflectens* (deciduous), the others are poikilohydric, curling their leaves in the dry period and thus protecting themselves against desiccation (Xavier et al. 2012). Finally, 15% (13 spp.) of the species occur in the two phytogeographic domain of the state (Table 1).

Overall, the majority of forest areas in the state of Sergipe, particularly those within Conservation Units, are under-sampled in terms of their flora, with approximately 18 areas having no recorded data (see Table 2). Consequently, there are widespread sampling gaps across all areas. However, only five out of the 23 areas had sampling efforts based in *speciesLink* (2023) and GBIF (2024), which were deemed insufficient (these areas include the Area of Relevant Ecological Interest Mata do Cipó, Grota do Angico Natural Monument, Ibura National Forest, Mata do Junco Wildlife Refuge, and PARNASI), highlighting persistent gaps in the state, particularly in Caatinga areas. Considering the relatively high richness recorded in PARNASI and Mata do Junco areas, despite the limited number of records (see Table 2), it is recommended that sampling efforts be prioritized in these regions.

Apart from the above-mentioned species with more restricted distribution, most taxa recorded in the state of Sergipe have a wide geographic distribution in Brazil [e.g. *Adiantum pulverulentum* L., *Cyathea microdonta* (Desv.) Domin, *Lygodium venustum* Sw., *Lygodium*

volubile Sw., *Microgramma vacciniifolia* (Langsd. & Fisch.) Copel. and *Telmatoblechnum serrulatum* (Figure 3)] (see Flora e Funga do Brasil 2023). These species are frequently mentioned in several works carried out in the Northeast (e.g. Pereira et al. 2011, Santiago et al. 2014, Farias et al. 2017, Andrade et al. 2022) and in other regions of Brazil (e.g. Prado & Hirai 2011, Gonzatti 2018, Lehn et al. 2018, Pena et al. 2019, Schindler et al. 2021). In relation to the conservation status, all species are considered by CNCFlora (2023) as less concern and/or not evaluated, except *Anemia dentata*. This widely distributed species in the national territory (Condack & Santiago 2023) was evaluated as a vulnerable taxon (CNCFlora 2023); however, the evaluation was performed based on its synonym, *Anemia mirabilis* Brade (Mickel 2016; Condack & Santiago 2023).

Regarding the substrate, terricolous species predominated (59,8%), followed by corticicolous (15%), rupicolous (10,9), aquatic (7,3%) and species occurring on more than two substrates (7,3%) [e.g. *Adiantum deflectens* and *Selaginella muscosa*]. These data corroborate other floristic inventories that have highlighted the terricolous substrate as the most diverse (e.g. Santiago et al. 2004, Pereira et al. 2013, Farias et al. 2017, Menezes & Labiak 2020, Andrade et al. 2022). The richness of species of terrestrial ferns and lycophytes can be explained by the greater diversity of environmental conditions, such as the availability of water and nutrients, promoted by this substrate (Xavier & Barros 2005). We suggest that future studies could conduct analyses between the representation of terrestrial ferns and lycophytes with the vegetation type and/or geo-environmental characteristics in the forested areas of the state of Sergipe.

Some species of ferns and lycophytes from the state of Sergipe, recorded in Flora e Funga do Brasil (2023), lack vouchers in any of the collections analyzed. However, these taxa are known to occur in neighboring states, suggesting their likely occurrence in Sergipe, despite not being cataloged. Therefore, the following species were classified as doubtful occurrences and were not included in this study: *Elaphoglossum lingua* (C.Presl) Brack., *Trichomanes pilosum* Raddi, and *Phlebodium pseudoaureum* (Cav.) Lellinger.

The list of species presented in this study updates the knowledge of ferns and lycophytes occurring in the state of Sergipe, with the compilation of new records and expansion of the geographic distribution of the species, thus bringing an important contribution to the local and national flora. Although there are sample gaps in the areas of the state of Sergipe, studies indicate that new records can be found, if collection efforts are increased (see Andrade et al. 2022), which instigates the continuation of new research, especially in little-known regions in the state. The present study is a starting point to build a dataset to support conservationist strategies in the region.

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Conflicts of Interest

The authors declare that they have no conflict of interest related to the publication of this manuscript.

Data Availability

Supporting data are available at https://doi.org/10.48331/scielodata.ASLWUX.

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