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New state records in brazilian *Agarista* (Lyonieae, Ericaceae)

Nuevos registros estaduales en *Agarista* brasileñas (Lyonieae, Ericaceae)

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Summary: Three new state-level records for the genus *Agarista* are reported in Brazil. The distribution of *Agarista revoluta* is expanded in Northeast Brazil, with new occurrences in Alagoas and Pernambuco. *Agarista eucalyptoides* is newly recorded for Espírito Santo, based on previously misidentified collections, raising to three the number of *Agarista* species known in the state. These two species are the most widely distributed in Brazil, with *A. eucalyptoides* also occurring in Uruguay. Descriptions, distribution maps, and an updated taxonomic key for Espírito Santo are provided as a supplement to the previously published flora. Additionally, all taxa were assessed according to their conservation status.

Key words: Alagoas, *campo rupestre*¸ Neotropic, Pernambuco, *restinga*.

Resumen: Se reportan tres nuevos registros a nivel estatal para el género *Agarista* en Brasil. Se amplía la distribución de *Agarista revoluta* en el Nordeste de Brasil, con nuevas ocurrencias en Alagoas y Pernambuco. *Agarista eucalyptoides* se registra por primera vez para Espírito Santo, con base en colecciones previamente mal identificadas, elevando a tres el número de especies de *Agarista conocidas* en el estado. Estas dos especies son las de distribución más amplia en Brasil, *A. eucalyptoides* también ocurre en Uruguay. Se presentan descripciones, mapas de distribución y una clave taxonómica actualizada para Espírito Santo como complemento de la flora publicada anteriormente. Además, todos los taxones fueron evaluados de acuerdo con su estado de conservación.

Palabras clave: Alagoas, campo rupestre¸ Neotrópico, Pernambuco, restinga.

Introduction

Agarista D. Don encompasses 35 species (Judd, 1995; Judd & Luteyn, 2006; Sampaio *et al*., 2023a) mostly neotropical, distributed among a wide variety of habitats, with an affinity to acidic soils and savannas. The genus is characterized by buds protected by more than two scales, leaves with dense reticulate venation, racemose or paniculate inflorescences, pendulous and pentamerous flowers, calyx lobes imbricate, corolla gamopetalous, cylindrical to campanulate, stamens with geniculate filaments, and dry capsular fruits (Judd, 1984, 1995).

Agarista sect. *Agarista* comprises 34 species and six varieties distributed across the Americas. In South America, its occurrence spans three main regions and nine countries: the Guiana Highlands (Venezuela, one species), the Andean Region (Bolivia, Colombia, Ecuador, Peru, and Venezuela, eight species), and the Brazilian Region (Argentina, Brazil, Paraguay, and Uruguay, 25 species), the latter being the most diverse (Dalastra *et al*., 2025, in press). In Brazil, 23 species are currently

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recorded, 21 of which are endemic. These are widely distributed across 15 states, with their greatest diversity and richness concentrated in the Espinhaço Range, eastern Brazil.

During the taxonomic revision of the genus we identified three collections of *Agarista eucalyptoides* G. Don from Espírito Santo state that had been misidentified as *A. oleifolia* G. Don. These specimens were overlooked in the Flora of Ericaceae of the Espírito Santo State (Romão *et al*., 2017), consequently, we report here *A. eucalyptoides* as a new record. Subsequently, we confirmed the identification of two collections of *A. revoluta* (Spreng.) Hook. f. ex Nied. var. *revoluta* for the states of Alagoas and Pernambuco, which had not been included in previous revisions (Kinoshita-Gouvêa, 1979; Judd, 1984, 1995; Romão *et al*., 2024), that represents new records (genus and species state level records) for both states. Therefore, here we update the distribution of *Agarista* in Brazil, increasing from 15 to 17 states in Brazil where the genus is distributed. Additionally, we are updating the number of species in the Ericaceae Flora of Espírito Santo, and providing a new taxonomic key to *Agarista* in the state.

Material and Methods

We reviewed floristic studies (Chamisso & Schlechtendal, 1826; Don D., 1834; Don G. 1834; Sleumer, 1959; Marques, 1975; Judd, 1979, 1984, 1995; Kinoshita-Gouvêa, 1979; Romão & Souza, 2003; Silva & Cervi, 2006; Marinero *et al*., 2007; Kinoshita & Romão, 2011, 2012; Deble *et al*., 2013; Romão *et al*., 2017; Dalastra & Heiden, 2022; Sampaio *et al*., 2023b; Romão *et al*., 2024) and geographical distribution of *Agarista* and Ericaceae in Brazil (GBIF, 2024: SpeciesLink, 2024; Reflora, 2024).

The diagnosis was based on the herborized samples. Macromorphological measurements were obtained using a stereomicroscope and a digital caliper. Reproductive structures were described after rehydration in warm water for one minute. Measurements indicated in descriptions match the minimum and maximum values of measured characters. General morphological features, color terms, and measurements were described according to Beentje (2016), and Radford *et al*. (1974). Specialized terminology follows Judd (1984, 1993, 1995). The measurements in the descriptions are indicated in terms of length and length × width, unless indicated differently in the description. For character frequency "sometimes" is used for 20-30%, "occasionally" for 10-20%, and "rare" for <10%. The distribution map was prepared using QGIS 3.34.3 (QGIS, 2024). We calculated the parameters of extension of occurrence (EOO) and area of occupancy (AOO) through GeoCAT (Bachman *et al*., 2011), using the default of 2 km² cell size as recommended by the IUCN (2010, 2024).

Agarista eucalyptoides G. Don, Gen. Hist. Dichlam. Pl. 3: 837. 1834.
Figs. 1; 2; 5A, D, H, L.

Shrubs to small trees, 1-3 m high; tortuous, sparsely branched; bark fissured, young twigs velutinous, older twigs glabrous to glabrescent. Leaves alternate to subopposite ± whorled, often slightly conduplicate; petioles slender and flexuous, 6-12.80 mm; blade ovate to oblong, 3.39-7.69 × 1.3-1.9 cm; base ovate to truncate, often aequilateral; apex acute to mucronulate; margins entire, sinuate, plane to slightly revolute near base; adaxial surface glabrous, puberulent at midvein; abaxial surface puberulent at midvein near base with sepia foveolae along midvein. Inflorescence axillary racemes, 6-16 flowered; rachis 0.6-5.67 cm, glabrescent to ferruginous-pubescent; pedicel 2.3-5.2 mm; floral bracts triangular, 1.3-2 mm; pedicel bracteoles narrowly triangular, 0.6-1.2 mm. Flowers with calyx lobes widely deltoid, pubescent along the edge, 1-1.7 mm; corolla white, long-urceolate, glabrous, 5.5-7.8 mm; staminal filaments villous, 4.5-6.8 mm; anthers 1-1.2 mm; ovary glabrous to slightly pubescent. Fruits dry capsule ovoid to short-ovoid, 3-5 × 4-5 mm, placentae subapical; seeds 1.8-2.5 mm.

Etymology: Similar to *Eucalyptus* L'Hér. (Myrtaceae) (Stearn, 1992).

Distribution and habitat: From BA to RS in Brazil, except PR (Judd 1984, 1995; Romão *et*

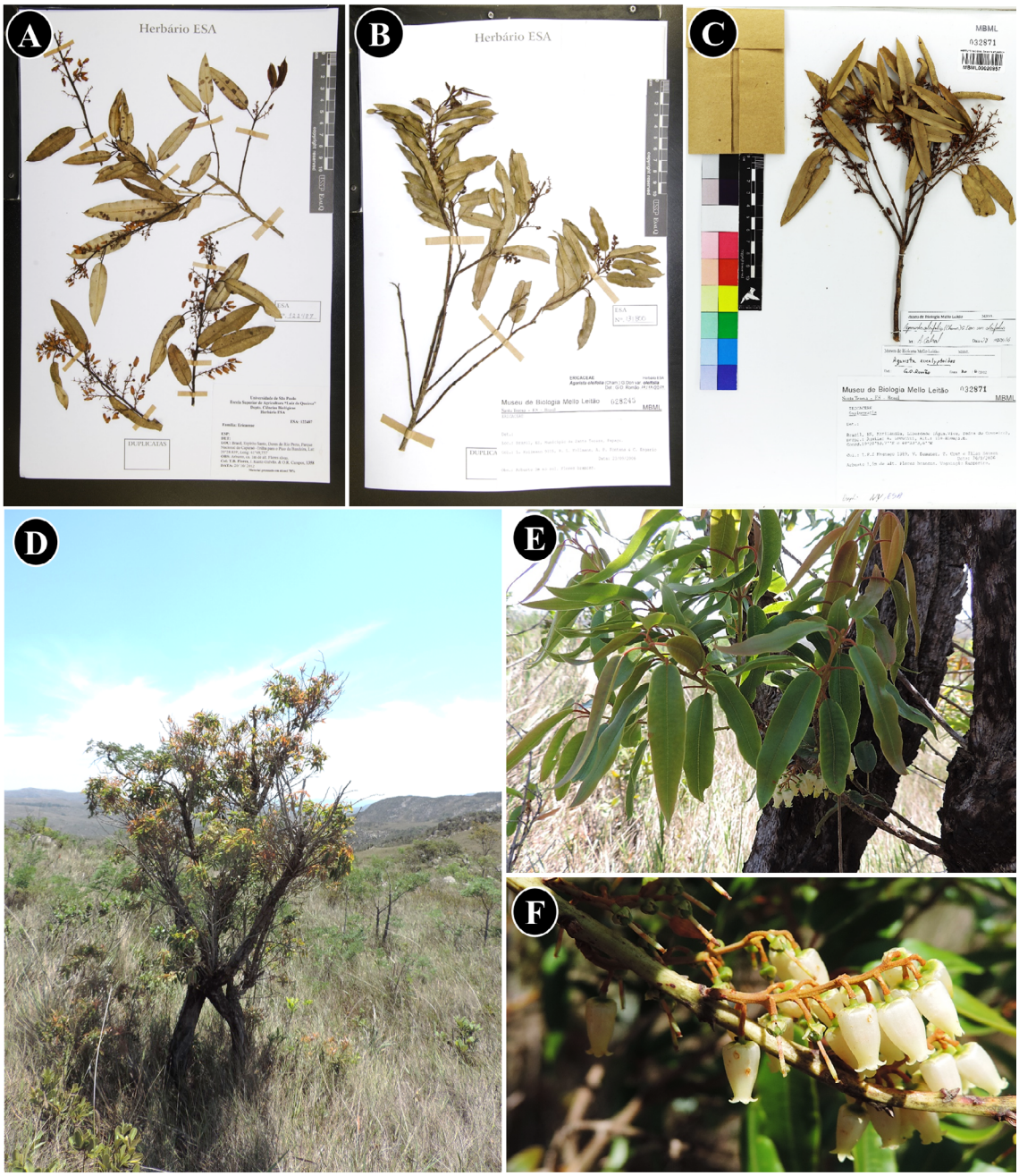

Fig. 1. *Agarista eucalyptoides* (Ericaceae). A-C: Photographs of herbarium specimens. A: *Flores 1358* (ESA). B: *Kollmann 9315* (RB). C: *Magnago 1389* (ESA). D: Habitat in *campos rupestres* of Serra do Cipó, Santana do Riacho, MG. E: Details of the leaves alternate to subopposite or ± whorled, with petioles slender and flexuous and blade ovate to oblong. E: Detail of the racemes with indumentum ferruginous on the inflorescence axis.

al., 2024), and Rivera Department in Uruguay (Grela & Brussa, 2005) (Fig. 2). Herein, we report new records for ES, at open and sunny rocky outcrops (Fig. 1).

Phenology: Flowering from July to February, April, and May. Fruits in January, February, May, July, October, and November; blossom and dry fruit in May.

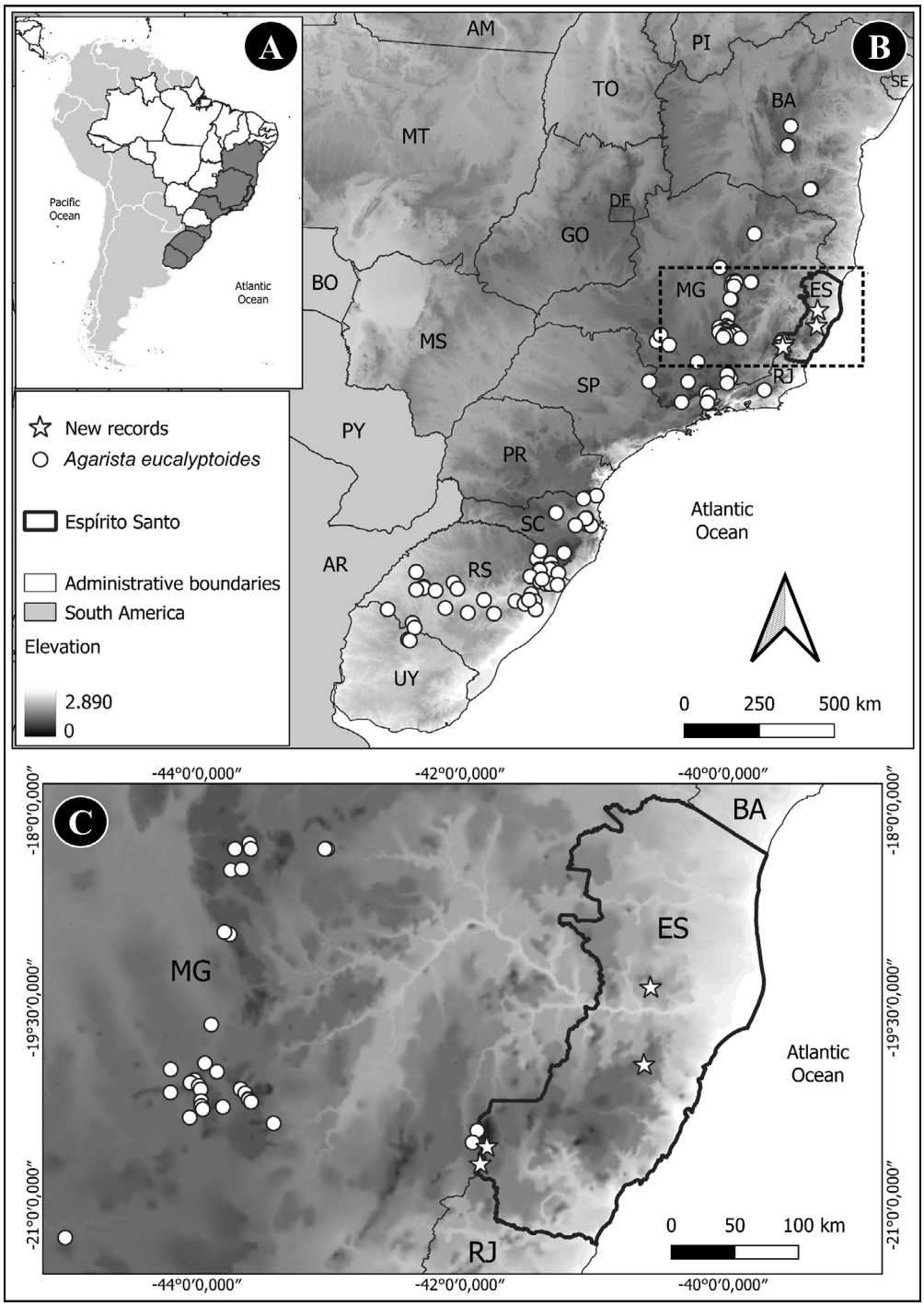

Fig. 2. Distribution of *Agarista eucalyptoides* (Ericaceae). A: Map of South America; light gray areas are neighboring countries and dark gray areas are territory of southeast of Brazil; continuous lines are country boundaries. B: Map of distribution and new records in Brazil, circle = current distribution, star= new records; AM= Amazonas, AR= Argentina, BA= Bahia, DF= Distrito Federal, ES= Espírito Santo, GO= Goiás, MA= Maranhão, MS= Mato Grosso do Sul, MT= Mato Grosso, PR= Paraná, PY= Paraguay, RS= Rio Grande do Sul, RJ= Rio de Janeiro, SC= Santa Catarina, SE= Sergipe, SP= São Paulo, TO= Tocantins, UY= Uruguay. C: Occurrence in Southeast Brazil; black to white scale represents the elevation ranges, lighter tones are higher and darker lower elevations.

Material examined: **BRAZIL. Espírito Santo:** Dores do Rio Preto, 20-X-2012, *Flores 1358* (ESA122487). Marilândia, Liberdade, 26-IX-2006, *Magnago 1389* (ESA131832, MBML00020957/032871, NY); Santa Tereza, 23-IX-2006, *Kollmann 9315* (ESA131800, MBML028245, VIES040599). **Minas Gerais**: Delfinópolis, 14-XI-2011, *Scatigna 24* (HUFU00051420); Serra do Cipó, km 13, 24-IV-1950, *Duarte 2694* (NY, RB). **Rio Grande do Sul**: Porto Alegre, 20-VII-1952, *Beetle 1673* (NY390806).

Conservation status: Least Concern (LC). *Agarista eucalyptoides* was analyzed under criterium B and the geographic range in the form of B1 (EOO). The species has a global Extent of Occurrence (EOO) of 1,157,320 km², indicating a wide geographic distribution well above the threshold for threat under criterion B1 (<5,000 km² for Endangered). Its Area of Occupancy (AOO) is 440 km², which is below the Endangered threshold for criterion B2 (<500 km²). The relatively low AOO reflects the species' restriction to high-altitude grasslands of the Atlantic Forest (Southern Highlands Grassland), rocky outcrops in the Pampa, and *campos rupestres* in Cerrado, rather than a direct indication of imminent threat. Such habitats are relatively isolated from intensive human activities, being largely unaffected by agriculture or ranching. Fire acts as a natural ecological process in Cerrado vegetation and does not constitute a direct threat unless its frequency exceeds natural regimes. Potential future threats may include iron ore mining. Considering the wide EOO and the lack of evidence for ongoing decline or extreme fragmentation, the species does not meet the subcriteria for a threatened category under criterion B and is therefore classified as Least Concern (LC) at the global scale according to IUCN Red List criteria (IUCN, 2024).

Agarista revoluta (Spreng.) Hook.f. ex Nied., Bot. Jahrb. Syst. 11(3): 236. 1889.
Figs. 3; 4; 5B, E, J.

Shrubs to small trees, 1-3 m high; twigs glabrous to pubescent. Leaves alternate, petioles thick, straight, and rigid, pubescent, 3-4.5 mm; blade ovate to elliptic, 2.02-3.95 × 0.7-2.2 cm; base rounded to subcordate; apex obtuse to acute mucronate apiculate; margin entire, revolute to strongly revolute; adaxial surface glabrous to pubescent at midvein; abaxial surface slightly pubescent to pubescent at midvein, especially near the base, frequently with ferruginous inconspicuous glands along midvein. Inflorescence axillary racemes; rachis 0.6-2.5 cm, canescent-pubescent; pedicel 3.1-4.5 mm; floral bracts triangular, 1.2-2 mm; pedicel bracteoles narrowly triangular, ± 1 mm. Flowers with calyx lobes triangular, glabrous to pubescent, 0.8-2 mm; corolla white, cylindrical, glabrous to slightly pubescent, 5-8 mm; staminal filaments villous 4-6 mm; anthers ± 1.4 mm; ovary glabrous to pubescent. Fruits dry capsules subglobose to ovoid, valves often slightly white margins, ± 4.2 × 5.3 mm; placentae subapical; seeds 2-3.5 mm.

Etymology: Relative to the leaves strongly revolute.

Distribution and habitat: The specimens previously unreported in the literature to Alagoas and Pernambuco (Fig. 3A, B) represent an expansion of *A. revoluta*. The species is widely distributed throughout sand dunes in coastal scrubs (*restingas*) from PE to RJ, also occurring in sandy and rocky soils inland at higher elevations in Quartzite Mountaintop Grasslands (*campos rupestres*) from the Cadeia do Espinhaço in northwestern MG and in the Chapada Diamantina in BA (Fig. 4).

Phenology: Flowering July to October.

Material examined: **BRAZIL. Alagoas**: Junqueiro, 9º54.14'S, 36º25.30'W, 23-IV-2006, *Santos 239* (MAC24495, RB492668). Pernambuco, Brejo da Madre de Deus, 15-IX-1973, *Andrade-Lima 73-7474* (F1930425, IPA29589). **Bahia**: Salvador, II-1998, *Nascimento 44* (HUEFS61073); Porto Seguro, 15º21'S, 3º59'W, 08-VI-2011, *Matos 13* (HUEFS180771, HURB5022). **Sergipe**: Areia Branca, 25-I-1992, *Wasum 8099* (UCS8090, NY390851).

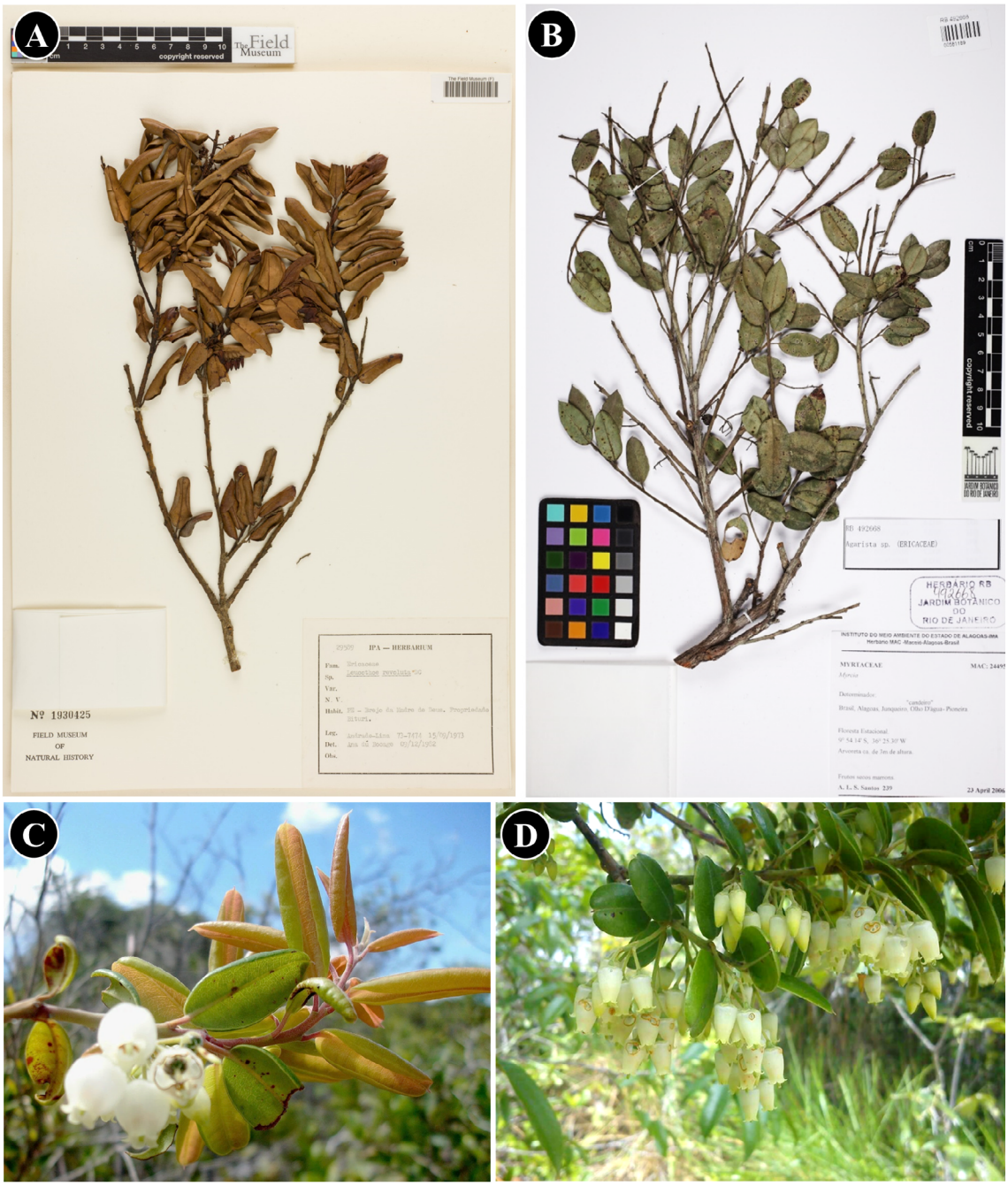

Fig. 3. *Agarista revoluta* (Ericaceae). A-B: Photographs of herbarium specimens. A: *Andrade-Lima 73-7474* (F). B: *Santos 239* (RB). C: Branch detail in habitat at Mata de São João, BA (HST021055, © Herbário Sérgio Tavares). D: Branch detail at Linhares, ES (iNaturalist, © Geovane Siqueira [https://www.inaturalist.org/observations/141554801]).

Conservation status: Least Concern (LC). *Agarista revoluta* was analyzed under criterium B and the geographic range in the form of B1 (EOO). The species has a global Extent of Occurrence (EOO) of 515,156 km², indicating a relatively wide geographic distribution well above the threshold for threat under criterion B1 (<5,000 km² for Endangered). Its Area

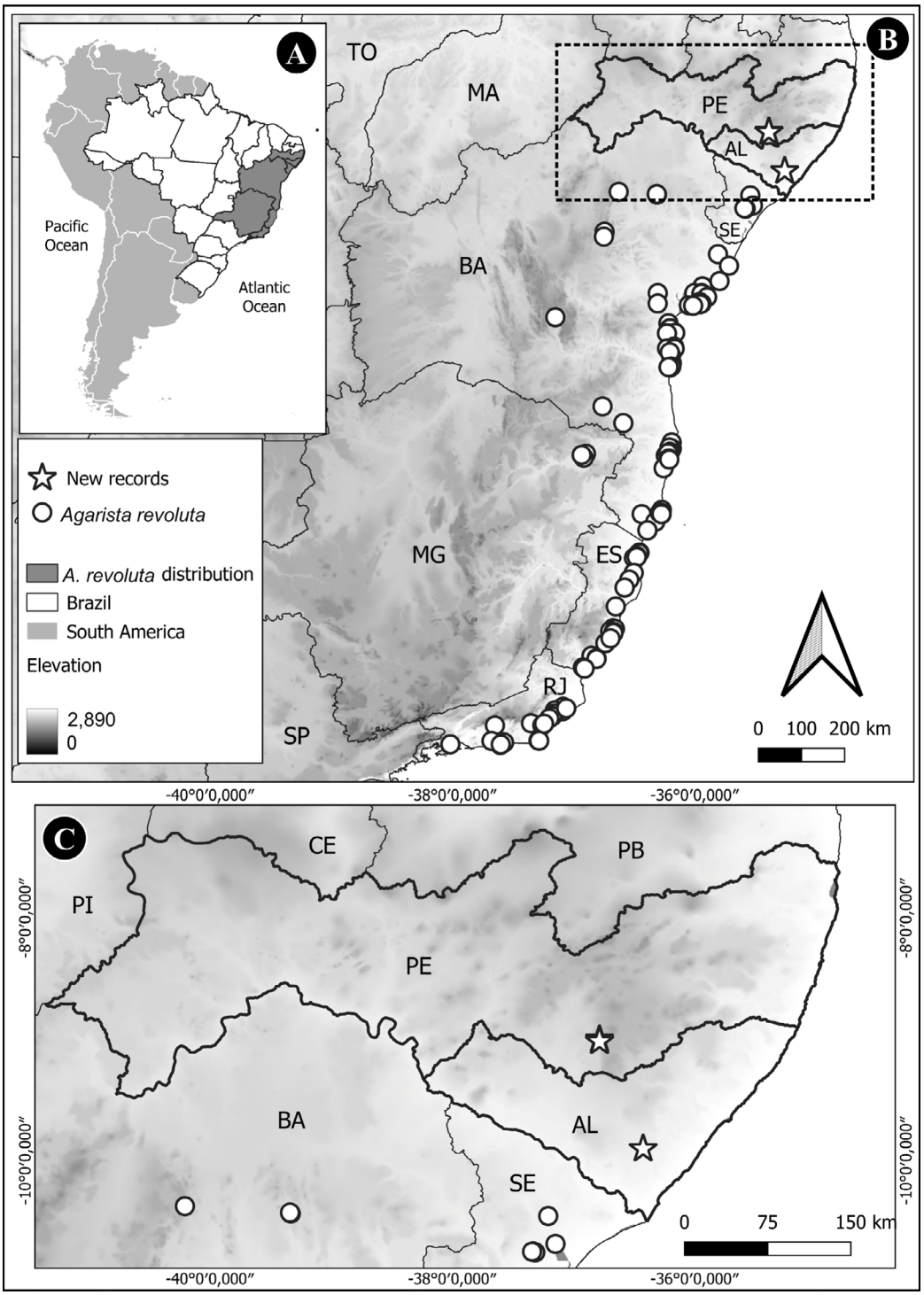

Fig. 4. Distribution of *Agarista revoluta* (Ericaceae). A: Map of South America, territory of southeast of Brazil in dark gray. B: Map of distribution and new records in Brazil, circle = previously known distribution, star = new records; AL= Alagoas, BA= Bahia, CE= Ceará, DF= Distrito Federal, ES= Espírito Santo, MA= Maranhão, PA= Pará, PB= Paraíba, PE= Pernambuco, PI, Piauí, RJ= Rio de Janeiro, SE= Sergipe, SP= São Paulo, TO= Tocantins. C: Occurrences in Northeast Brazil; black to white scale represents elevation ranges, lighter tones are higher and darker lower elevations.

Fig. 5. Relevant characters of *Agarista* from Espírito Santo, Brazil. A, D, H, L: *A. eucalyptoides* (*Dalastra 3*, ICN). A: Leaf base rounded to truncate, margin flat. D: Inflorescence axis with indumentum ferruginous. H: Capsule short-ovoid to subglobose. L: Seed elongate. B, E, J: *A. revoluta* (*Mattos 2486*, RB). B: Leaf base rounded to very slightly cordate. E: Inflorescence axis densely pubescent. J. Placentae subapical. C, F, G, I, K, M: *A. oleifolia* (*Romão & Dantas 1485*, ESA). C: Leaf base cuneate. F: Inflorescence axis glabrous. G: Inflorescence axis moderately pubescent. I: Capsule subglobose to short-ovoid. K: Placentae ± central. M: Seed short.

of Occupancy (AOO) is 300 km², which is below the Endangered threshold for criterion B2 (<500 km²). The relatively low AOO reflects the species' restriction to *restinga* vegetation along the Brazilian coast and *campos rupestres* in Chapada Diamantina-BA, rather than a direct indication of imminent threat. *Restingas* are increasingly impacted by human activities, and potential threats include coastal urbanization and real estate expansion, although many populations still occur in protected or relatively undisturbed areas. Considering the wide EOO and the lack of evidence for ongoing population decline or extreme fragmentation on a global scale, the species does not meet the sub-criteria for a threatened category under criterion B, and is therefore classified as Least Concern (LC) at the global scale according to IUCN Red List criteria (IUCN, 2024).

Discussion

Romão *et al.* (2017) in the Flora of Espirito Santo: Ericaceae recorded two species in *Agarista* to the State, *A. revoluta* and *A. oleifolia*. Nonetheless, the specimens *Kollman 9315* (Fig. 1A), *Flores 1358* (Fig 3B), and *Magnago 1389* (Fig. 3C) previously identified as *A. oleifolia* actually corresponds to *A. eucalyptoides*. *Agarista eucalyptoides* shows variation in stem and leaf ferruginous pubescence, degree of undulation of leaf margin, length and flexibility of the petiole, inflorescence length, which may have led to its misidentification as *A. oleifolia*; even so, *A. eucalyptoides* is not closely related to the other two species occurring in ES. *Agarista oleifolia* and *A. revoluta* (Judd. 1984, 1995) can be recognized by the moderately to densely ferruginous indumentum of its inflorescence axis and pedicel (Figs. 1F: 5D). Besides, *A. eucalyptoides* can be distinguished from *A. oleifolia* by its usually longer leaves, subapical placentae (vs. ± central placentae [Fig. 5K]), and longer seeds of 1.8-2.5 mm long (Fig. 5L) (vs. 0.5-1.3 mm long [Fig. 5M]), and from *A. revoluta* by its flat margins (Fig. 5A) (vs. slightly to strongly revolute margins [Fig. 5B]).

Agarista revoluta occurs from Rio de Janeiro to Sergipe along coastal scrubs (*restingas*), except in Minas Gerais, occurring in sandstone outcrops with white sand in Jequitinhonha (Fig. 4), and along the Espinhaço Range in Bahia, in rocky grasslands close to sandy grasslands in Chapada Diamantina. The collection *Santos 239* was previously misidentified as a species of Myrtaceae. On the other hand, the collection *Andrade-Lima 73-7474* was correctly identified under the synonym *Leucothoe revoluta* (Spreng.) DC. (1839: 604) at the Field Museum Herbaria and available, but was not included in previous revisions (Kinoshita-Gouvêa, 1979; Judd. 1984, 1995; Romão *et al*., 2024).

Agarista revoluta is the species with the widest distribution in northeastern Brazil, being the only species recorded to other states in the northeastern region other than Bahia, and the unique species of the genus known to occur in coastal scrubs (*restinga*) of the Atlantic Rainforest. It is a species that can be easily recognized by its characteristic revolute leaves (Fig. 5B), moderate-sized, obtuse to retuse-mucronate leaves and elongate inflorescences. The species is also divided into two varieties: *A. revoluta* var. *revoluta* and *A. revoluta* var. *velutina* Judd (Judd, 1984). These varieties are separated primarily by the indumentum on the abaxial leaf surface, which is velutinous in *A. revoluta* var. *velutina*. This variety is known only to the locality of Dunas do Abaeté, Salvador-BA.

Key to *Agarista* in Espírito Santo State

1. Petioles 6–12.8 mm, thin and flexuous. Inflorescence axis ferruginous-pubescent. .... *A. eucalyptoides*

1'. Petioles 2–7 mm, thick and straight. Inflorescence axis glabrous to whitish-pubescent. 2

2. Branches glabrous to moderately pubescent; leaf margins flat, blade lanceolate to narrowly elliptical. Placentae ± central. ..... *A. oleifolia*

2'. Branches densely pubescent; leaf margins strongly revolute, blade elliptical to ovate. Placentae subapical. ..... *A. revoluta* var. *revoluta*

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Author Contributions

Planning the manuscript: CHD, GH. Funding raising for the research: CHD, GH. Data Collection (herbaria collections review, specialized literature review): CHD, GH. Data analysis (quantitative and qualitative, plates, maps, and notes): CHD. Visualization: CHD, GH. General inputs and revision: GH. Writing: CHD. Writing-review and editing: CHD, GH.

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