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Research article

New species and new records in *Agarista* (Ericaceae) from the Peruvian Andes

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Agarista (Ericaceae) is currently represented in Peru by three species. Here, we update this number to five, adding new taxa based on the recognition of a taxonomic novelty and new records. The new species *Agarista eugenifolia* differs from all congeneric species by an abaxially sulcate midvein. It is only known from two locations in the province of San Marcos in Cajamarca Department, and the province of Huamachuco in La Libertad Department. We also report *A. mexicana* var. *mexicana* as a newly recorded species and variety for both South America and Peru, with remarkable similarity to the disjunct nominate variety from Mesoamerica and noteworthy differences regarding leaf shape and short fascicle-like inflorescences in comparison to the other Peruvian *Agarista* species. Along with morphological diagnosis, description, and risk assessment of the new species, we provide a key to identify the *Agarista* from Peru, a map with the geographic distribution of the five species occurring in the country, illustrations, and taxonomic notes.

Keywords: endemism, Lyonieae, new record, new species, tropical mountains, Vaccinioideae

Introduction

Agarista D. Don ex G. Don (Ericaceae, Vaccinioideae, Lyonieae) is a monophyletic genus of trees and shrubs with 34 species recognized by superior ovaries and capsular fruits. The genus occurs in Africa (*A. sect. Agauria* D. Don), including Madagascar and the Mascarene Islands, and the Americas (*A. sect. Agarista*). *Agarista* is characterized by leaves with dense reticulate venation, buds protected by more than two scales, racemose or paniculate inflorescences, pentamerous and pendulous flowers, cylindrical to campanulate gamopetalous corollas, imbricate calyx lobes, stamens with geniculate filaments and dry capsular fruits (Judd 1979, 1984, 1995, 2006).

Although morphologically similar, each of the two sections in *Agarista* can be distinguished on the basis of vegetative and reproductive characters. The American



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species in *Agarista* sect. *Agarista* have non-papillose leaves, long epidermal cells, interrupted hypodermis in the leaf blade, and capsular fruits with sub-apical placentation and a stipe with largest diameter near the apex (Stevens 1971, Judd 1984, 1995). Judd (1984, 1995) described the distribution of this section as occurring in five main geographic areas: coastal plain of the southeastern United States (Florida), Mexican region (Mexico, Belize, El Salvador, Guatemala, Honduras, and Nicaragua), Guyana highland (Venezuela), Andean region (Bolivia, Colombia, Ecuador, and Peru), and Brazilian region (Argentina, Brazil, Paraguay, and Uruguay). Each of these regions represents exclusive sets of species and most species are endemic to one of them. The Brazilian region is the most species-rich, with 20 species, of which 17 are endemic to Brazil (Romão et al. 2024). The Andean region is the second most species-rich area for the genus (eight species) distributed across Colombia, Ecuador, Peru, and Bolivia. Peru has the highest number of species recorded within this region where three species previously recorded occur, and two are endemic to the country (Judd 1984, 1995).

During a review of herbarium specimens at the Missouri Botanical Garden (MO) and New York Botanical Garden (NY), two specimens of *Agarista* from the Andes drew our interest, with both notably differing from other species known from Peru. After comparative morphological analysis, we confirmed that the specimen from NY is a new species and the specimen from MO represents *A. mexicana* var. *mexicana*, newly reported here from South America and Peru. Later, additional material was identified in the herbarium USM, expanding the distribution of these taxa in Peru, with one additional record to *A. eugeniifolia* and another one to *A. mexicana* var. *mexicana*. These discoveries increase the number of species in Peru from three to five, with three endemics to the country. We provide a morphological diagnosis, description, and risk assessment of the new species; a key to identify each of the five species of *Agarista* from Peru; a map with the geographic distribution of the five species occurring in the country, illustrations and taxonomic notes.

Material and methods

We conducted a comprehensive review of the taxonomic literature on *Agarista*, along with analysis of type specimens. The literature sources consulted for this review included Lamark (1783), Thunberg (1817), Bentham and Hooker (1876), Chamisso and Schlechtendal (1826), Pohl (1828/1829), Don (1834), Candolle (1839), Meisner (1863), Hooker (1876), Gray (1878), Niedenzu (1890), Taubert (1893), Drude (1897), Small (1914), Sleumer (1938, 1935, 1959), Stevens (1971) and Judd (1979, 1984, 1995). This review helped us ensure that the proposed new species was really new and that the new record had not been previously described and/or reported in the existing literature.

In addition to the primary specimens from MO and NY, specimens from additional herbaria were examined (A, ALCB, BHC, BRIT, CESJ, ECT, ESA, F, FLOR, GH, HAS, HPBR, HUCS, HUEFS, HUFU, HURB,

ICN, LaSalle, MBM, MPUC, PACA, PEL, OUPR, R, RB, SMDB, SPF, UPCB, US) either in person during visits or through loans. Additional duplicates of these specimens were accessed through high-quality digital images available online (GBIF 2024, Silva [Jabot] 2024, JSTOR 2024, Refflora 2024, specieslink 2024). The Peruvian herbaria CHAX, CPUN, HH, HNOP, KUELAP, MOL, UNJ, and USM kindly provided specimen images and additional collection information.

Descriptions were based on examined herbarium specimens. We implemented a morphological species concept for taxonomic decisions that follows Cronquist (1978), defining species as the smallest groups of individuals consistently and notably distinguishable through average characteristics with ingroup variation and distinct diagnostic traits not overlapping with the variation and diagnostic traits found in the related outgroups. In this context, species represent the smallest group of distinct populations, consistently separated from one another by clear gaps within the continuum of biotypes (Cronquist 1978, Bisby and Coddington 1995).

Morphological characters were measured with the aid of a Leica® stereomicroscope and an MTX® digital caliper (0–150 MM). Reproductive structures were rehydrated for 1 min in warm water. The measurements provided in the taxonomic descriptions correspond to the minimum and maximum values of the measured characters. The description of general morphological features, color terminology, and measurements follows Beentje (2016), Radford et al. (1974), and Payne (1978). 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 with QGIS ver. 3.34.3 (QGIS 2024). We followed the International Union for Conservation of Nature (IUCN) guidelines to assess the threat risk of the species. The extent of occurrence (EOO) and area of occupancy (AOO) were calculated with GeoCAT (Bachman et al. 2011) and default setting of 2 km² cell size as recommended by the IUCN (2010, 2024).

Taxonomic treatment

***Agarista eugeniifolia* Dalastra & G.Heiden sp. nov.**
(Fig. 1, 2[B, D, F], 3[B, D, F, H], 4)

A species that differs from all congeneric species by its abaxially sulcate midvein.

Type: Peru, Cajamarca: San Marcos Province, Cochamarca, carretera entre Condormarca y San Marcos, 17 Oct. 1964, I. Sánchez V. 21 (holotype: NY [2153199]; isotype: CPUN [2506], image!).

Etymology

The specific epithet *eugeniifolia* refers to the similarity of the leaf shape of the new species to that of *Eugenia uniflora* (Myrtaceae). *Eugenia uniflora* (commonly known as Surinam

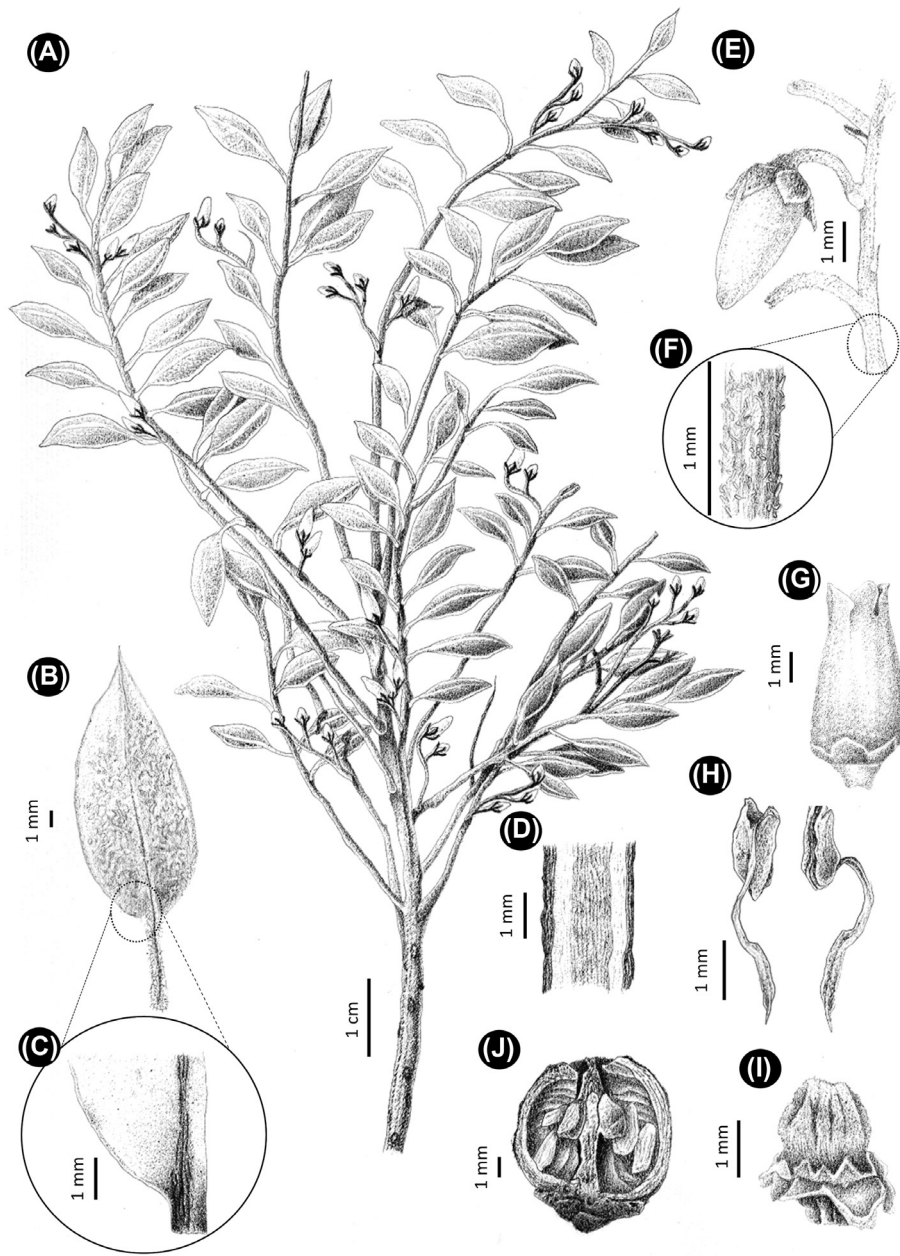


Figure 1. Illustration of *Agarista eugeniifolia* sp. nov. (Ericaceae), drawn from holotype. (A) Branch, (B) leaf, (C) leaf blade abaxial surface showing sulcate midvein, (D) cross section of twig showing non-chambered pith, (E) part of raceme showing flower bud, (F) raceme rachis showing indumentum, (G) flower, (H) stamen in lateral-ventral view (right) and anther in dorsal view (left), (I) ovary, (J) cross section of capsule showing \pm central placentation. Drawn by João Castor.

cherry or pitanga) is a species native to eastern Brazil, particularly in the Atlantic rainforest. It is also found in other regions of South America, including Paraguay, Argentina, and Uruguay. Beyond its natural range, *E. uniflora* has been widely cultivated throughout tropical and subtropical America, including the Caribbean, Central America, and parts of North America (such as Florida). Its adaptability and edible fruits have contributed to its spread in both cultivated and naturalized environments.

Description

Shrub, 2–3 m tall; twigs puberulent, or glabrous to moderately pubescent; pith nonchambered; bud conduplicate, 1 mm. Leaves petiolate; petiole thick, 3.1–4.8 mm long, puberulent; blade flat, coriaceous, ovate to lanceolate, 0.9–1.6 \times 0.3–0.7 cm, obtuse to cuneate at base, with entire margin, attenuate to acuminate at apex, at adaxial surface glabrous to sparsely puberulent near extreme proximal portion of midvein, with unicellular trichomes, midvein abaxially sulcate, at abaxial

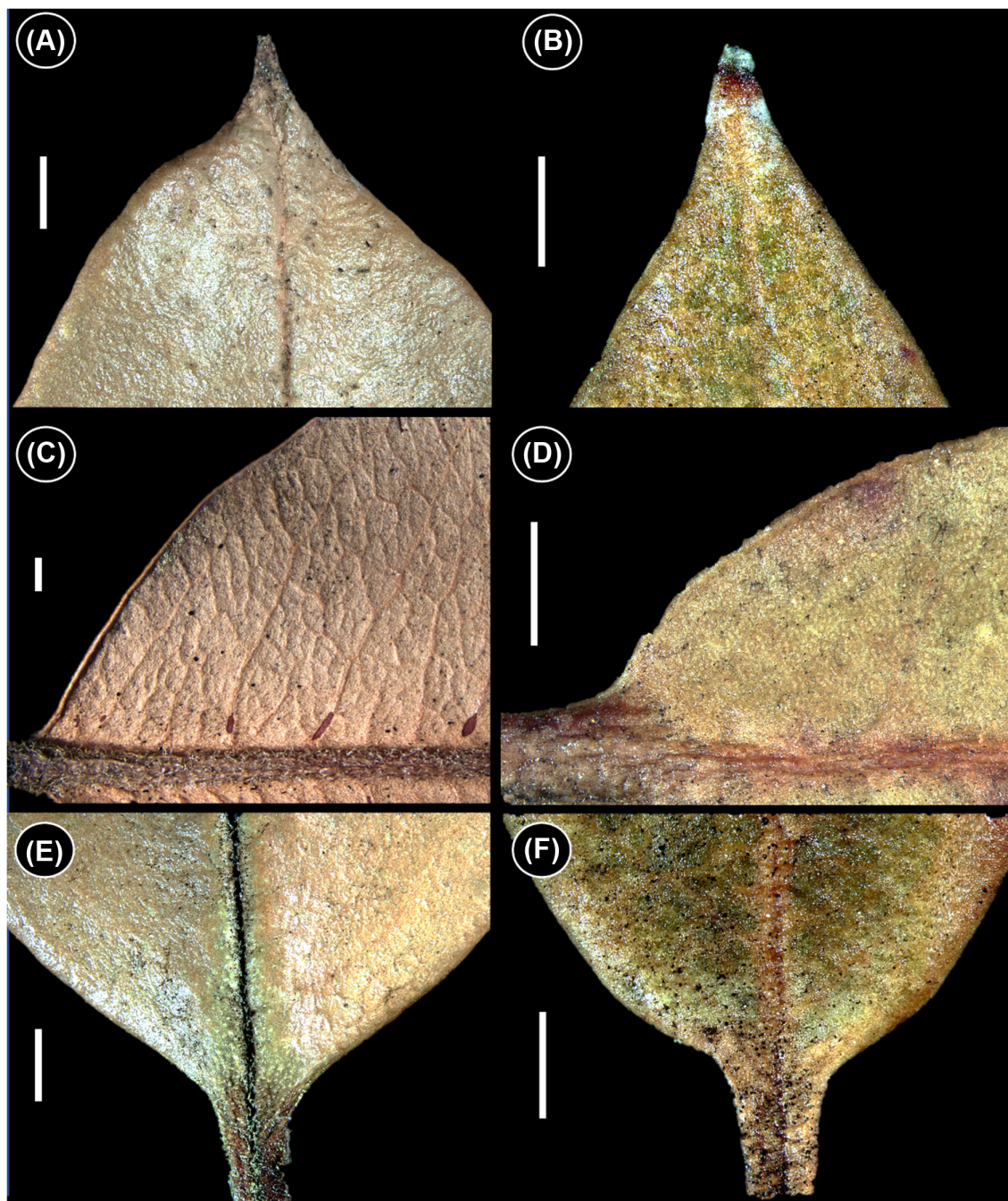


Figure 2. Comparative vegetative character states between *Agarista eugeniifolia* sp. nov. and *A. albiflora*. (A) Leaf apex acuminate, (B) leaf apex acuminate, (C) abaxial surface glabrous, with midvein raised from the lamina, (D) abaxial surface with midvein sulcate, (E) leaf base broadly cuneate, (F) leaf base subtrotund. Scale bars 1mm. *Agarista eugeniifolia* (Sánchez 21, NY 2153199): (B), (D), (F) and *A. albiflora* (Campos & López 2571, NY 02153197): (A), (C), (E).

surface glabrous to densely puberulent with brownish foveate dots sparsely distributed along midvein. Inflorescences axillary, racemose, 5–12-flowered; rachis 1.1–3.5 cm long, moderately to densely ferruginous-pubescent, with aduncate trichomes; bracts triangular to narrowly triangular, 0.5–10 mm long, pubescent; pedicels 2.4–4.9 mm long, sparsely to densely pubescent; bracteoles 2, borne on basal portion of pedicel, triangular to narrowly triangular, 0.5–0.7 mm,

pubescent. Calyx lobes deltoid, 1.0–1.3 × 0.6–1.7 mm, whitish- to ferruginous-pubescent, acuminate at apex; corolla pale red to pinkish, cylindrical-urceolate, 5.9–7.8 × 2.2–3.0 mm, glabrous. Staminal filaments 2.6–3.0 mm long, slightly villos; anthers 1.1–1.3 mm long. Ovary moderately to densely ferruginous-pubescent. Fruits capsular, ovoid to short-ovoid, 2–3 × 2.0–2.5 mm; placentation ± central; seeds fusiform to semi-spheroid, ca 0.5 mm.

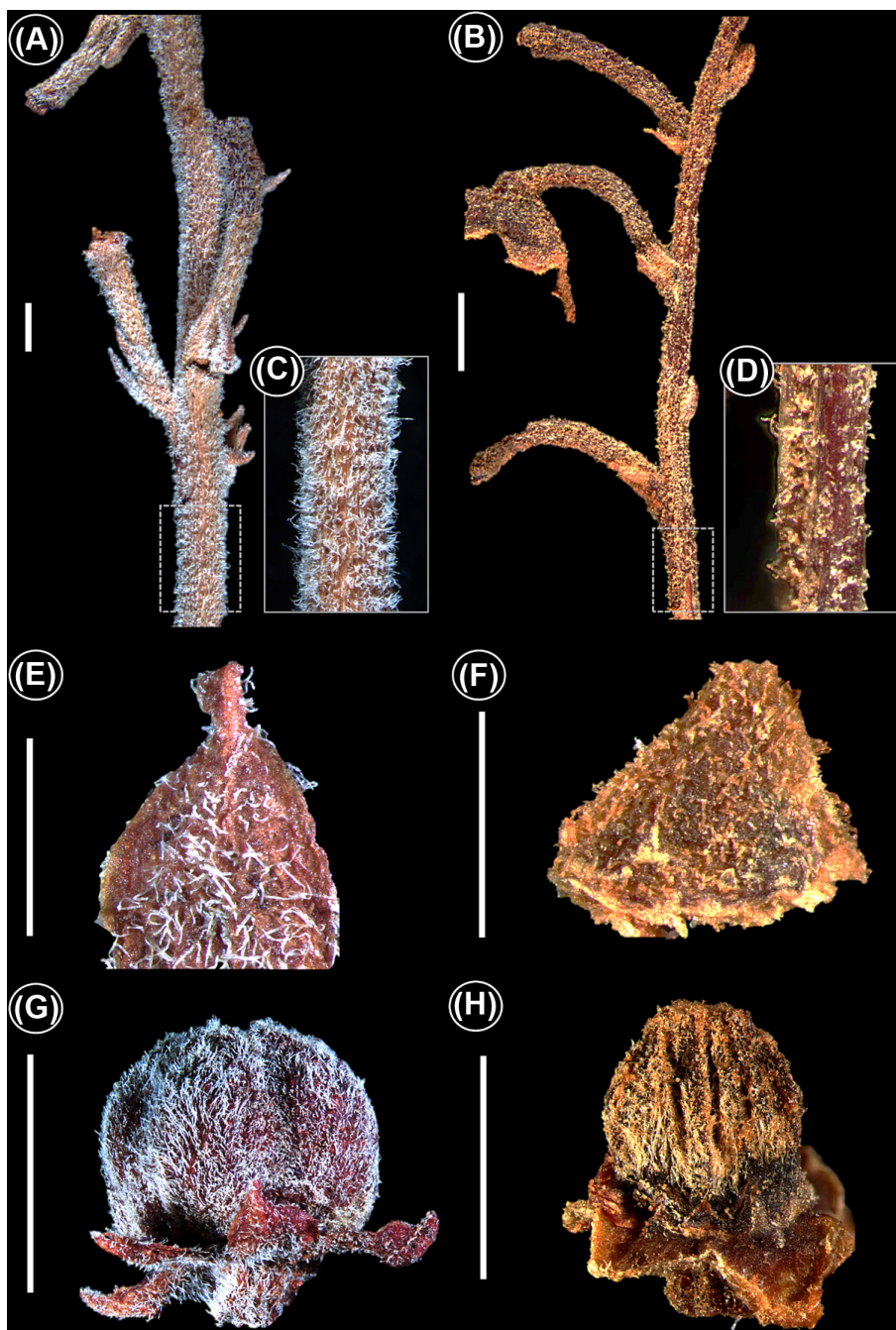


Figure 3. Comparative reproductive character states between *Agarista eugeniifolia* sp. nov. and *A. albiflora*. (A) Inflorescence axis with indumentum white pubescent, (B) inflorescence axis with indumentum ferruginous pubescent, (C) inflorescence trichomes acicular to geniculate and whitish in the inflorescence rachis, (D) inflorescence trichomes aduncate and ferruginous in the inflorescence rachis, (E) calyx lobe triangular with acicular to geniculate white trichomes, (F) calyx lobe deltoid with aduncate ferruginous trichomes, (G) ovary whitish pubescent, (H) ovary ferruginous pubescent. Scale bars 1mm. *Agarista eugeniifolia* (Sánchez 21, NY 2153199): (B), (D), (F) and (H); *A. albiflora* (Campos & López 2571, NY 02153197): (A), (C), (E), and (G).

Additional specimen examined

Peru, La Libertad: Prov. Huamachuco, Sanagoran, 24 Oct. 2002, 7°46'57.7"S, 78°08'22.9"W, A. Cano et al. 12456 (USM 176151).

Phenology

Collected in October with flowers and mature fruits from the current season and bearing dry old fruit from the previous season.

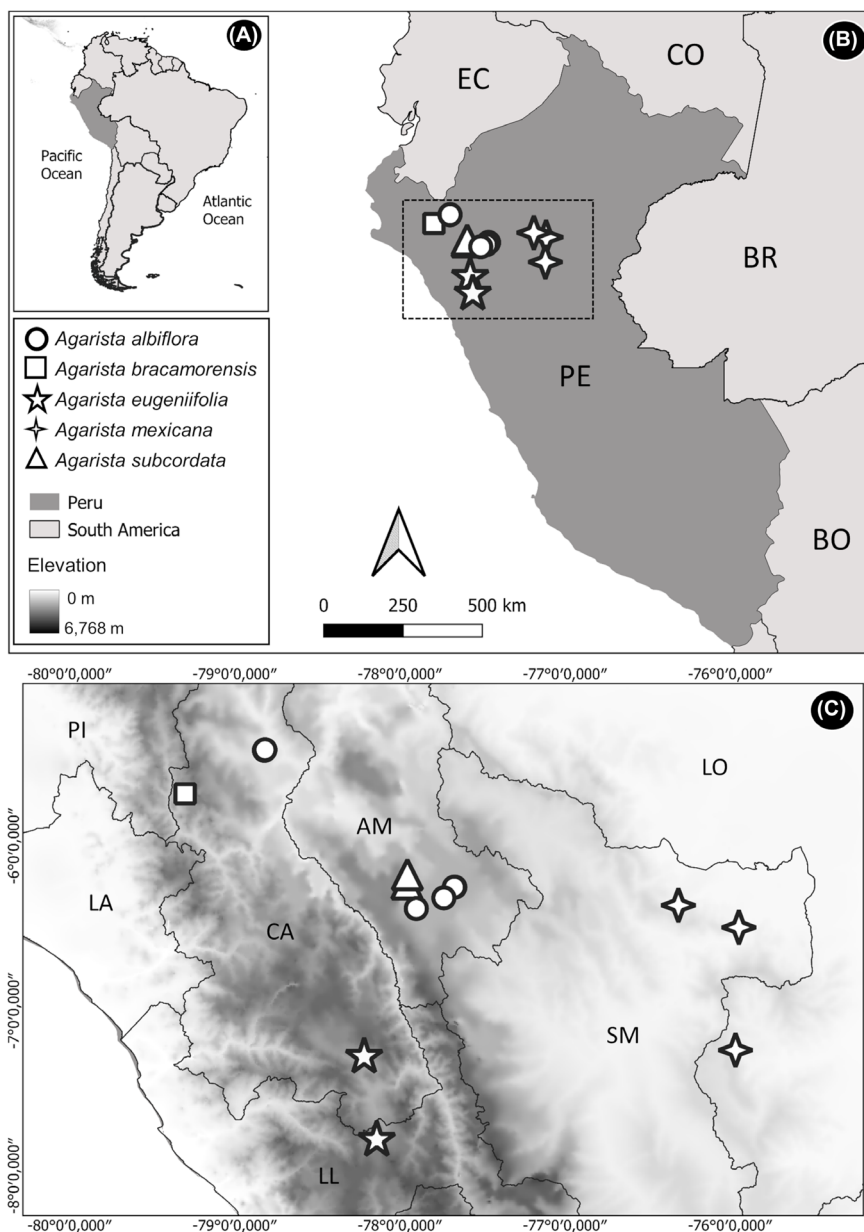


Figure 4. Distribution of *Agarista* (Ericaceae) in Peru. (A) The map in the upper left corner indicates the position of Peru in South America. (B) The map in the upper right corner corresponds to the general distribution of *Agarista* in Peru; the rectangle in dashed black line highlights the inset area, enlarged in (C), below showing the occurrence of *Agarista* in Peru; AR=Argentina; BO=Bolivia; BR=Brazil; CO=Colombia; EC=Ecuador; PE=Peru. (C) Occurrence of *Agarista* in Peru by department; continuous lines represent the boundaries between Peruvian departments; black to white scale represents elevation ranges, whereas darker tones characterize higher elevations and lighter lower elevations; AM=Amazonas, CA=Cajamarca, LA=Lambayeque, LL=La Libertad, LO=Loreto, PI=Piura, SM=San Martin; circle=*A. albiflora*, square=*A. bracamorensis*, polygonal star=*A. eugeniifolia*, isotoxal star=*A. mexicana*, triangle=*A. subcordata*.

Distribution and ecology

Agarista eugeniifolia is endemic to Peru, occurring in seasonally dry tropical forest (SDTF) (Linares-Palomino 2006). It grows on rocky outcrops in Andean grasslands, rocky ravine, and riparian scrub, at 2864 m a.s.l. in San Marcos, Cajamarca, and between 2700–2800 m a.s.l. in Huamachuco, La Libertad (Fig. 4). According to Morronone et al. (2022), this region belongs to the biogeographical province of Ucayali (38) in the South Brazilian biogeographic dominion.

Conservation status

'Critically Endangered' (CR) (D+B1a+B2a). *Agarista eugeniifolia* was assessed under criterion B of IUCN (2024) and the geographic range in the form of B1 (EEO), and B2 (AEO). The extent of occurrence (EEO) and the area of occupancy (AOO) could not be calculated in GeoCAT (Bachman et al. 2011) because this species is only represented by two gatherings. According to IUCN criterion B2, this species is recognized as 'Critically Endangered' (CR) (IUCN 2024) due the

AOO < 10 km². According to IUCN 15.1 (2024) 'If a taxon is only known from its type locality and there is no information on its current status or possible threats, the taxon should be listed as Data Deficient (DD)'. In the case of *A. eugeniifolia*, despite the species being known only from two localities, other potential localities were explored in the Área de Conservación Regional Bosques Secos del Maraón and no more individuals of the species was recorded, and then the taxon can be listed as Critically Endangered D (IUCN 15.1 2024).

Agarista eugeniifolia occurs in the Seasonal tropical dry forest ecosystems, that are found at high altitudes in the inter-Andean regions of Peru. The area of occurrence of the species is located in the Kastanosolic and Lito-Cambisolic region, which predominate at altitudes between 2200 and 4000 m a.s.l. These forests are generally characterized by fertile soils resulting from the accumulation of sediments from sandstone and limestone rocks weathering, which have favored agricultural practices since pre-colonial times. The seasonal tropical dry forests at this elevation range exhibit species diversity, although their floristic richness may be lower compared to lower-altitude regions. Additionally, areas with these characteristics tend to be less explored, and their flora remains poorly studied, highlighting the importance of conservation and further research. Therefore, it reflects the significant biodiversity and ecological importance of Peru's seasonal tropical dry forests, which are increasingly threatened by deforestation and human activities (Linares-Palomino 2006).

The Government of Peru established in 2021 the Área de Conservación Regional Bosques Secos del Maraón in Cajamarca, covering part of the province of San Marcos. This is a unique ecosystem in the world and one of the most important places for environmental conservation in Peru. It is located within the Tropical Andes conservation hotspot, as it records one of the highest rates of endemism (Marcelo-Pená et al. 2015). However, the records of *A. eugeniifolia* are from outside of this Conservation Unity and, so far, there is no record of the species inside the conserved area.

Notes on *Agarista eugeniifolia*

The type of *Agarista eugeniifolia* was previously identified as *A. albiflora* (B.Fedtsch. & Basil.) Judd. This determination was probably based on the leaf size in *A. albiflora* and comparison

with the specimen J.L. Luteyn et al. 15498 (NY00668906) from Chachapoyas, Amazonas, which has smaller leaves than those commonly found in *A. albiflora* (Fig. 1B).

Morphometric analysis for *Agarista eugeniifolia* comprised the 22 characters used by Judd (1984, 1995) to delimit six informal groups. We identified 10 exclusive characters states (\pm well branched shrub or tree, stem non-glaucous, pith non-septate to irregularly septate, leaf blade usually ovate to elliptic, leaf apex often acuminate, leaf base not cordate, abaxial glandular dots lacking or inconspicuous, lamina \pm flat to slightly revolute at margins, lamina coriaceous, \pm flexible when dry, margin entire, inflorescence axillary, calyx lobes usually < 3 mm long, corolla white, to pink tinged at apex, ovary at least slightly pubescent, and capsule valves not very thick walled) between this new species and *A. albiflora*, confirming that, although sharing some morphological characteristics, they are readily distinguishable. Most of the shared features between the two species were considered by Judd (1984, 1995) as plesiomorphic. These data suggest a closer relationship of *A. eugeniifolia* to the '*A. albiflora* group' (Judd 1984). This group is restricted to northwest South America and comprises two species (*A. subcordata* (Dunal) Judd and *Agarista bracamorensis* (Kunth) G.Don). The *A. albiflora* group and *A. eugeniifolia* share a set of characteristics (\pm well branched shrub or tree, stem non-glaucous, pith nonseptate to irregularly septate, leaf blade usually ovate to elliptic, leaf apex often acuminate, abaxial glandular dots lacking or inconspicuous, abaxial leaf surface glabrous or sparsely pubescent, lamina coriaceous, \pm flexible when dry, margin entire, inflorescence axillary, calyx lobes usually < 3 mm long, corolla white, to pink tinged at apex, and capsule valves not very thick walled), that are likely symplesiomorphic.

Agarista eugeniifolia has smaller leaves than collections of *A. albiflora* from Chachapoyas (NY00668906) (Table 1, Fig. 1). *Agarista eugeniifolia* mostly differ from *A. albiflora* by the leaf blades ovate and lanceolate (versus ovate to elliptic), leaf apex attenuate to acuminate (Fig. 2B) (versus acute to rounded-mucronate; Fig. 2A), leaf size 0.9–1.6 \times 0.3–0.7 cm (versus 1.0–6.7 \times 0.8–2.7 cm), inflorescence length 1.1–3.5 cm (versus 3–10 cm), inflorescence axis and ovary with moderately to densely distributed ferruginous pubescent and shorter aduncate trichomes (Fig. 3H) (versus whitish

Table 1. Morphological differences between *Agarista eugeniifolia* sp. nov. (Ericaceae) and *A. albiflora* (Judd 1984, 1995).

Character	<i>A. eugeniifolia</i>	<i>A. albiflora</i>
Leaf blade base	obtuse to cuneate	broadly cuneate to rounded
Leaf blade shape	ovate and lanceolate	ovate to elliptic
Leaf blade apex	attenuate to acuminate	acute to rounded-mucronate
Leaf blade size (cm)	0.9–1.6 \times 0.3–0.7	1.0–6.7 \times 0.8–2.7
Inflorescence length (cm)	1.1–3.5	3–10
Inflorescence axis indumentum	sparsely to densely ferruginous-pubescent, trichomes undulate	sparsely to densely whitish-pubescent, trichomes straight
Ovary	sparsely to densely ferruginous-pubescent, trichomes undulate	sparsely to densely whitish-pubescent, trichomes straight
Placentation	\pm central	subapical
Capsule shape	ovoid to short-ovoid	subglobose to short-ovoid
Capsule size (mm)	2–3 \times 2.0–2.5	3–5.5 \times 4.0–7.5

indumentum and longer acicular to geniculate trichomes; Fig. 3G), placentation \pm central (versus subapical), capsule ovoid to short-ovoid (versus subglobose to short-ovoid), and capsule 2–3 mm \times 2.0–2.5 mm (versus 3.0–5.5 mm \times 4.0–7.5 mm; Fig. 2–3).

Agarista mexicana (Hemsley) Judd var. *mexicana* (Judd 1979, p. 495) (Fig. 4–6)

Andromeda mexicana Hemsley (Hemsley 1881, p. 282).

Leucothoë mexicana Small (Small 1914, p. 57).

Type: Mexico, Oaxaca: Sierra San Pedro Nolasco, 1843/1844, C. Jürgensen 866 (holotype: K 000037374, image!; isotypes: G 239230/1, G 239230/2, images!).

Specimens examined

Peru, Loreto: Ucayalli Province, Distrito Pampa Hermosa, Parque Nacional Cordillera Azul, Sector Shanshuico, 9 July 2022, R. Vásquez et al. 47262 (HOXA, USM 347525, MO).

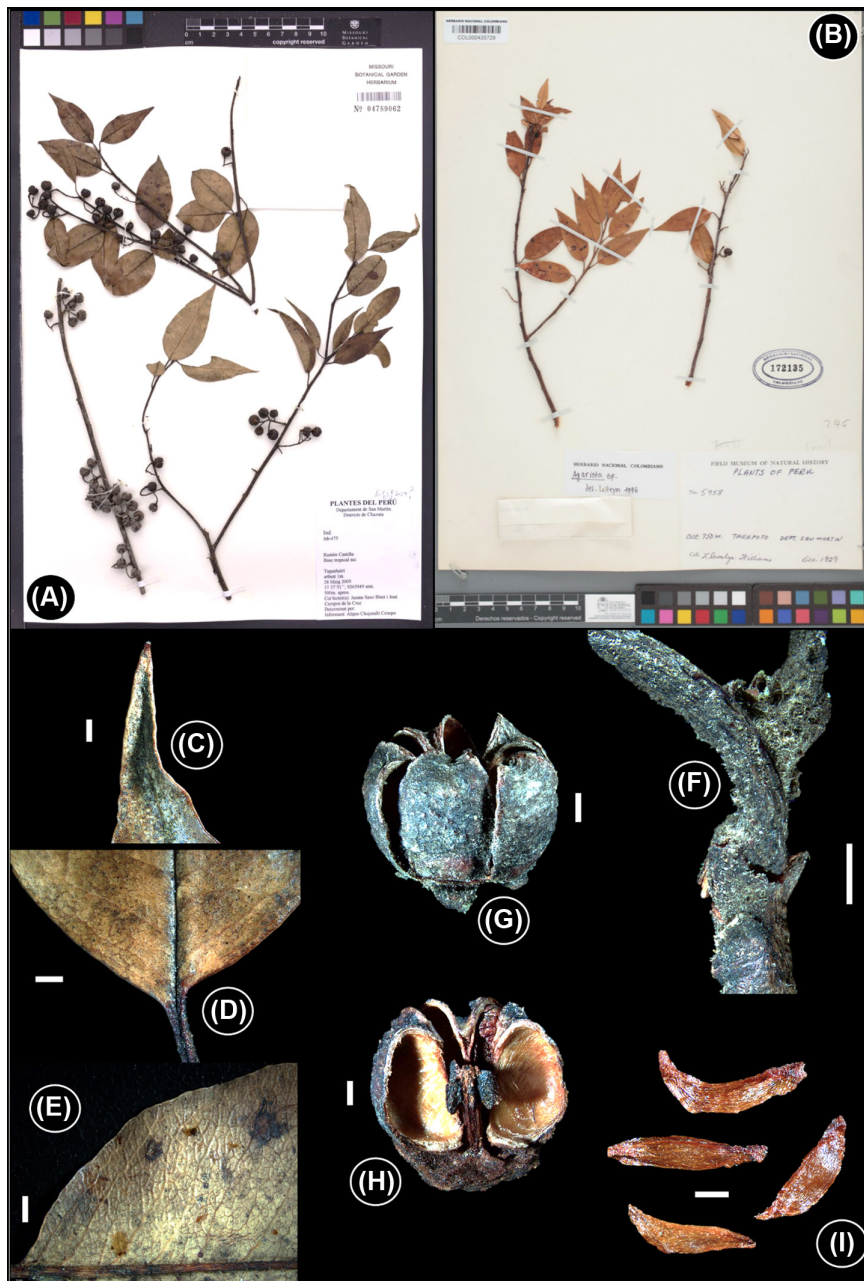


Figure 5. Collections of *Agarista mexicana* var. *mexicana* from Peru and morphological details. (A) Specimen J.S. Biset & J.C. de la Cruz 475 (MO1459070), (B) specimen L. O. Williams 5958 (COL000435729). Photo details in (C)–(D) images from J.S. Biset & J.C. de la Cruz 475 (MO1459070), where (C) leaf apex, (D) leaf base, (E) abaxial surface, (F) inflorescence axis (fascicle-like), (G) capsule, (H) subapical placentae, (I) seeds.

San Martín: Chazuta, 18 May 2005, J. S. Biset & J. C. de la Cruz 475 (MO 04789062); Tarapoto, 1 Dec. 1929, L.O. Williams 5958 (COL 000435729) [<http://www.biovirtua.l.unal.edu.co/en/collections/detail/678293/>].

Distribution and habitat

Belize (Cayo), El Salvador (Morazán and Santa Ana), Guatemala (Baja, Chiquimula, El Progreso, Jalapa, San Marcos, Santa Rosa, and Zacapa), Honduras (Comayagua, La Paz, Yoro), Mexico (Chiapas, Guerrero, Michoacán, Oaxaca, Hidalgo, Jalisco, Mexico, Querétaro, Tejuipilco, and Veracruz), Nicaragua (Nueva Segovia), and Peru (San

Martin, Loreto) (Fig. 4). In Seasonally Dry Tropical Forest, primary forest on low hills, in sandstone soil, and sandy soil humid forests.

Notes on *Agarista mexicana* var. *mexicana*

This is a new record of *Agarista mexicana* var. *mexicana* to South America and Peru. It is also a new record for the genus *Agarista* in the Departments of Loreto and San Martín, Peru (Fig. 4). The long ovate leaf blades (Fig 6B), with acuminate apex (Fig. 5C), narrowly cuneate to rounded base (Fig. 5D), entire margin (slightly undulate) (Fig. 6E), plane to very slightly revolute at the proximal portion of the blade, best viewed in



Figure 6. *Agarista mexicana* var. *mexicana* in situ in Peru, Loreto, Ucayalli Province, Distrito Pampa Hermosa. (A) Flowering branch and short inflorescences fascicle-like, (B) twigs with dry fruits, flowers and leaves, highlighting the long ovate and flat leaves, with acuminate apices, and base narrowly cuneate to rounded, (C) dry fruits. Photos: Rodolfo Vásquez Martínez (R. Vásquez et al. 47262).

the collection of L.O. Williams 5958 (Fig. 6B) are diagnostic characteristics for this species. Moreover, the short inflorescence axis (0.5–2.0 cm long), fascicle-like, is distinct from that of other species of *Agarista* occurring in Peru (Fig. 4F–5).

Agarista species in Peru are typically found between 1800 and 2864 m a.s.l. However, *Agarista mexicana* var. *mexicana* is known to occur at much lower elevations, ranging from 170 to 1500 m a.s.l. in Mesoamerica, in the biogeographical regions of the Mexican transition zone (biogeographical provinces of Chiapas Highlands, Sierra Madre del Sur, Sierra Madre Occidental and Transmexican Volcanic Belt) and the biogeographical Mesoamerican dominion (biogeographical provinces of Balsas Basin, Mosquito and Veracruz) (Morrone et al. 2022). In Peru, this variety has been recorded at even lower elevations, between 500 and 750 m a.s.l., in the Seasonally Dry Tropical Forest and in sandy soil humid forests. This new record significantly expands the geographic range of *Agarista* in Peru, now including the Departments of San Martín and Loreto, extending the species' known elevational range considerably.

The Seasonally Dry Tropical Forests are recognized for their biodiversity and ecological complexity. Although typically associated with higher altitudes and specific soil conditions, variations of this vegetation have been recorded at lower elevations, reflecting the adaptation of plant species to different microclimates and soil conditions. The area of occurrence of *Agarista mexicana* var. *mexicana* in Peru can be described as a transition between Seasonally Dry Tropical Forests and Humid Forests, possessing characteristics of both types of vegetation. Seasonally dry tropical forests at lower altitudes typically exhibit distinct vegetation with species adapted to drought conditions, while they can also occur in humid sandy soils, which reduce environmental stress on the local flora (Linares-Palomino 2006).

The flora of the Pampa Hermosa and Tarapoto area highlights the presence of species occupying unique niches, including those adapted to sandy soils, which tend to be more drained and less fertile. The forests in this region are notably species-rich but face increasing pressure from natural resource exploitation and deforestation. Therefore, conserving these regions, especially in areas like the Cordillera Azul National Park, is vital to preserving this biodiversity and its associated ecological functions (Linares-Palomino 2006).

According to Judd (1984, 1995), *Agarista* is distributed in five major geographic areas throughout the Americas. The majority of the species are endemic to a single major biogeographic area, except for *A. duckei* which occurs in both the Guyana Highland and Brazilian Region, and *A. mexicana* var. *mexicana*, which is newly reported in the northern Andes of South America for the first time and represents a significant disjunction from the previously known main center of distribution in Mexico, Guatemala, Belize, El Salvador Honduras, and Nicaragua (Fig. 4).

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Key to the species of *Agarista* in Peru

1. Leaves up to 1.6 cm × 0.3–0.7 cm 2
– Leaves longer than 1.5 cm × 0.30–0.45 cm 3
2. Petiole 1.5–4.0 mm long; leaf blade revolute; inflorescence axis whitish-pubescent; pedicel 1.5–3.0 mm long; corolla 4.5–6.0 × 2.0–3.5 cm; ovary glabrous; placentation subapical *A. bracamorensis*
– Petiole 3.1–4.8 mm long; leaf blade flat; inflorescence axis ferruginous-pubescent; pedicel 2.4–4.9 mm; corolla 5.9–7.8 × 2.2–3.0 cm; ovary ferruginous pubescent; placentation ± central *A. eugeniifolia*
3. Leaf apex acuminate-mucronate; inflorescence axis 0.5–2.0 cm long *A. mexicana*
– Leaf apex acute to rounded-mucronate; inflorescence axis 3–10 cm long 4
4. Leaf blades thick coriaceous, rigid when dry, rounded to slightly cordate at base; inflorescences with aduncate trichomes *A. subcordata*
– Leaf blades thinly coriaceous, flexible when dry, broadly cuneate to cordate at base; inflorescences with straight trichomes *A. albiflora*

Author contributions

Claudenice Hilda Dalstra: Conceptualization (lead); Data curation (lead); Formal analysis (lead); Funding acquisition (equal); Investigation (lead); Methodology (lead); Project administration (equal); Resources (equal); Validation (equal); Visualization (lead); Writing – original draft (lead); Writing – review and editing (equal). **Peter W. Fritsch:** Funding acquisition (supporting); Methodology (supporting); Resources (supporting); Validation (supporting); Writing – review and

editing (equal). **Morgan R. Gostel**: Funding acquisition (supporting); Methodology (supporting); Resources (supporting); Validation (supporting); Writing – review and editing (equal). **Gustavo Heiden**: Conceptualization (equal); Funding acquisition (equal); Methodology (equal); Project administration (equal); Resources (equal); Supervision (lead); Validation (equal); Visualization (equal); Writing – review and editing (equal).

Data availability statement

This article has no additional data.

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