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Astrotrichilia leroyana, sp. nov. (Meliaceae, Melioideae):
a new species from northeastern Madagascar

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Astrotrichilia leroyana, sp. nov. (Meliaceae, Melioideae): a new species from northeastern Madagascar

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ABSTRACT

KEY WORDS
Meliaceae,
Astrotrichilia,
conservation,
Daraina,
Loky-Manambato,
Madagascar,
medicinal plants,
new species.

A new species of *Astrotrichilia* (Harms) J.-F. Leroy ex T. D. Penn. & Styles (Meliaceae, Melioideae) from seasonally dry forests in northern Madagascar is described. The new species is most similar to *A. asterotricha* (Radlk.) Cheek, but differs in a number of vegetative characters and has a distinct geographical distribution. A previous study of the new species has shown it to possess secondary compounds with antiproliferative properties towards ovarian cancer cells, highlighting the urgent need for its conservation. Images, a distribution map, and a preliminary assessment of risk extinction using the IUCN Red List Criteria are provided for the new species.

RÉSUMÉ

MOTS CLÉS
Meliaceae,
Astrotrichilia,
conservation,
Daraina,
Loky-Manambato,
Madagascar,
plantes médicinales,
espèce nouvelle.

Astrotrichilia leroyana, sp. nov. (Meliaceae, Melioideae): une espèce nouvelle du nord-est de Madagascar. Une nouvelle espèce dans le genre *Astrotrichilia* (Harms) J.-F. Leroy ex T. D. Penn. & Styles (Meliaceae, Melioideae) des forêts saisonnièrement sèches au nord de Madagascar est décrite. La nouvelle espèce se rapproche de *A. asterotricha* (Radlk.) Cheek, mais s'en distingue par un certain nombre de caractères végétatifs et une répartition géographique distincte. Une étude précédente menée sur la nouvelle espèce a montré qu'elle possédait des composés secondaires aux propriétés limitant la prolifération des cellules cancéreuses de l'ovaire, illustrant le besoin urgent de sa conservation. Des illustrations, une carte de distribution et une évaluation préliminaire du risque d'extinction selon les critères de la Liste Rouge de l'UICN sont fournies.

INTRODUCTION

Astrotrichilia (Harms) J.-F. Leroy ex T. D. Penn. & Styles (Meliaceae) is a genus endemic to Madagascar and is currently composed of 12 accepted species that occur in a variety of vegetation types, including both humid and seasonally dry forests (Leroy & Lescot 1996; Schatz 2001; Madagascar Catalogue 2019). The Meliaceae have not yet been treated in the *Flore de Madagascar et des Comores* series (Humbert *et al.* 1936), although Jean-François Leroy (1915-1999) was actively working with Michèle Lescot (1939-) on a revision of the family in Madagascar at the time of his death, and Lescot continued the work until she retired several years later. Their unfinished manuscript, which is on file at the Paris herbarium, has served as a basis for recent taxonomic novelties in the family (e.g., Callmander *et al.* 2011a). While evaluating the species diversity of *Astrotrichilia* for the *Catalogue of Plants of Madagascar* (Madagascar Catalogue 2019), several specimens from various localities in northeastern Madagascar were examined that did not fit the description of any of the 12 known species from Madagascar.

In northeastern Madagascar, the area known colloquially as Daraina was recently officially designated as part of a protected area with a provisional status as a Multiple Usage Forest Station (Station forestière à usages multiples), and it is now designated as the Loky-Manambato Protected Landscape (Paysage protégé). Over several years, intensive botanical exploration in this area by the Conservatoire et Jardin botaniques de la Ville de Genève (in partnership with the NGO Fanamby and the Université d'Antananarivo in Ankatso) and the Missouri Botanical Garden in Antananarivo (in partnership with the Parc Botanique et Zoologique de Tsimbazaza and the International Cooperative Biodiversity Group [ICBG] program) has resulted in the discovery of many new plant species, including the Annonaceae (Deroin & Gautier 2008), Asphodelaceae (Castillon & Nusbaumer 2014), Bignoniaceae (Callmander & Phillipson 2011; Callmander *et al.* 2011b), Convolvulaceae (Deroin *et al.* 2008), Gentianaceae (Wohlhauser & Callmander 2012), Leguminosae (Thulin *et al.* 2014), Malvaceae (Wahlert *et al.* 2014), Melastomataceae (Stone 2017), Phyllanthaceae (Ralimanana 2017), Sarcolaenaceae (Lowry *et al.* 2014) and Violaceae (Wahlert *et al.* 2013).

In this paper, we describe the new species *Astrotrichilia leroyana* Wahlert, Phillipson & Callm., sp. nov. which is known from several localities east and south-east of Antsiranana, Sahafary Forest, and the mountains of Loky-Manambato. We also provide an illustration and a distribution map of the new species with its most similar relative *A. asterotricha* (Radlk.) Cheek and present a preliminary risk of extinction assessment using the IUCN Red List Categories and Criteria (IUCN 2012).

SYSTEMATICS

Astrotrichilia leroyana Wahlert, Phillipson & Callm., sp. nov.
(Figs 1; 2)

Shrub or small tree, similar to *A. asterotricha* (Radlk.) Cheek by the sparse to dense, finely stellate indument of the young stems, petioles, abaxial surface of the leaflets and inflorescence axes, and

by the similar size and shape of the flowers and fruits, but it differs from this species by its shorter petioles 2-4.5 cm long (vs 4-5.5 cm long), its smaller, elliptic to obovate leaflets 1.5-5 × 0.7-2 cm (vs leaflets ovate-lanceolate up to 2.5-8 × 1.5-3.5 cm), the rather obscure tertiary venation on the upper leaflet surface (vs tertiary venation visible), and the shorter inflorescence 2-4.2 cm long (3.5-10 cm long).

TYPUS. — Madagascar. Prov. Antsiranana, Reg. SAVA. Daraina, forêt de Bekaraoka, 13°06'37"S, 49°42'29"E, 230 m, 12.II.2004, fl., *L. Nusbaumer & P. Ranirison 1159* (holo-, G[G00028077]!; iso-, P[P00853255]!; K!, MO!, TEF).

PARATYPES. — Madagascar. Prov. Antsiranana, Reg. SAVA. Daraina, forêt de Solaniampilana-Maroadabo, 13°05'46"S, 49°34'51"E, 110 m, 9.III.2004, fr., *L. Gautier et al. 4507* (G!, P!, K, MO!, TEF); *ibid. loc.*, 13°05'23"S, 49°35'02"E, 120 m, 11.III.2004, fl., *L. Gautier et al. 4563* (G!, P!, K, MO!, TEF); Antsahatitezana, 4 km E d'Ankijomantsina, 13°06'55"S, 49°29'09"E, 70 m, 31.IX.2005, fr., *R. Guittou et al. 185* (CNARP, G!, MO!, P!, TAN); Daraina, forêt de Solaniampilana-Maroadabo, 13°05'31"S, 49°34'35"E, 150 m, 8.II.2006, buds, *L. Nusbaumer & P. Ranirison 2191* (G!); *ibid. loc.*, 13°06'17"S, 49°34'06"E, 575 m, 5.II.2006, buds, *L. Nusbaumer & P. Ranirison 2245* (G!); Andrafiabe, Ambolobozobe, à 2 km W du village d'Ambolobozobe, forêt d'Ankonahona, 12°31'26"S, 49°31'29"E, 20 m, 25.I.2007, fl., *S. Rakotonandrasana et al. 1091* (CNARP, G!, MO!, P!, TAN); Daraina, forêt d'Antsaharaingy, 12°54'15"S, 49°39'26"E, 30 m, 21.IV.2004, fr., *P. Ranirison 732* (G!, P!, K, MO!, TEF); Prov. Antsiranana, Reg. DIANA. Vovo Village District, c. 6 km from Diego Suarez [Antsiranana] on Diego Suarez-Vovo village road, and c. 1.5 km S of beach on Indian Ocean, 12°19'05"S, 49°23'07"E, 85 m, 21.IV.1993, fl., *D. K. Harder et al. 1670* (MO!, P!, TAN); Antsiranana II, Ankarongana, 12°36'18"S, 49°26'34"E, 258 m, 7.XI.2006, fl., *R. Ranaivojaona et al. 1511* (G, K, MO!, P, TAN); Andrafiabe, Ambolobozobe, 1 km NE d'Ambolobozobe, forêt d'Ampanasagna, 12°31'01"S, 49°32'14"E, 50 m, 1.II.2005, fl., *F. Ratovoson et al. 843* (CNARP, MO!, P!, TAN); Beampingo, 4 km N d'Ambolobozobe, 12°29'00"S, 49°31'25"E, 10 m, fl., 8.II.2005, *F. Ratovoson et al. 927* (CNARP, MO!, P!, TAN); bassin de la Saharaina, forêt de Sahafary, 23.X.1954, fr., *Service Forestier 11372* (P!).

DISTRIBUTION. — *Astrotrichilia leroyana*, sp. nov. is known from forest fragments in the mountains of Loky-Manambato (Ampondrabe, Ambohitsitondroina, and Solaniampilana forests), and the coastal area just to the north, including Ampanasagna forest near Ambolobozobe, and Sahafary forest; it does not co-occur with any other known species in the genus (Fig. 3). In contrast, *Astrotrichilia asterotricha* is common and widespread in western and south-central Madagascar, but its known range barely extends north of the Boeny Region, more than 300 km to the south-west of Loky-Manambato.

HABITAT. — *Astrotrichilia leroyana*, sp. nov. grows in seasonally dry, deciduous to semi-deciduous forests on compacted soils or in littoral forests on brown or white sands.

ETYMOLOGY. — The new species is named in honor of Jean-François Leroy (1915-1999), whose taxonomic studies have enhanced the knowledge of the flora of Madagascar, especially in the Rubiaceae and the Meliaceae. Leroy described ten of the 12 currently recognized species of *Astrotrichilia*, including four that were co-authored with Lescot (Leroy & Lescot 1996; Madagascar Catalogue 2019).

VERNACULAR NAME AND USES. — The vernacular name "hazondinta" was recorded for the collection *R. Guittou et al. 185*. The same name has been recorded for *Chloroxylon fabo* Capuron (Rutaceae) in Madagascar, a tree with similarly pinnately compound leaves and valued for its medicinal properties (Schatz 2001; Quattrocchi 2012). "Hazondinta" appears to indicate a tree with sticky sap: "hazo" means tree, and "dinta", although it also means leech or caterpillar, is likely in this context to be a form of "dity", a Malagasy word

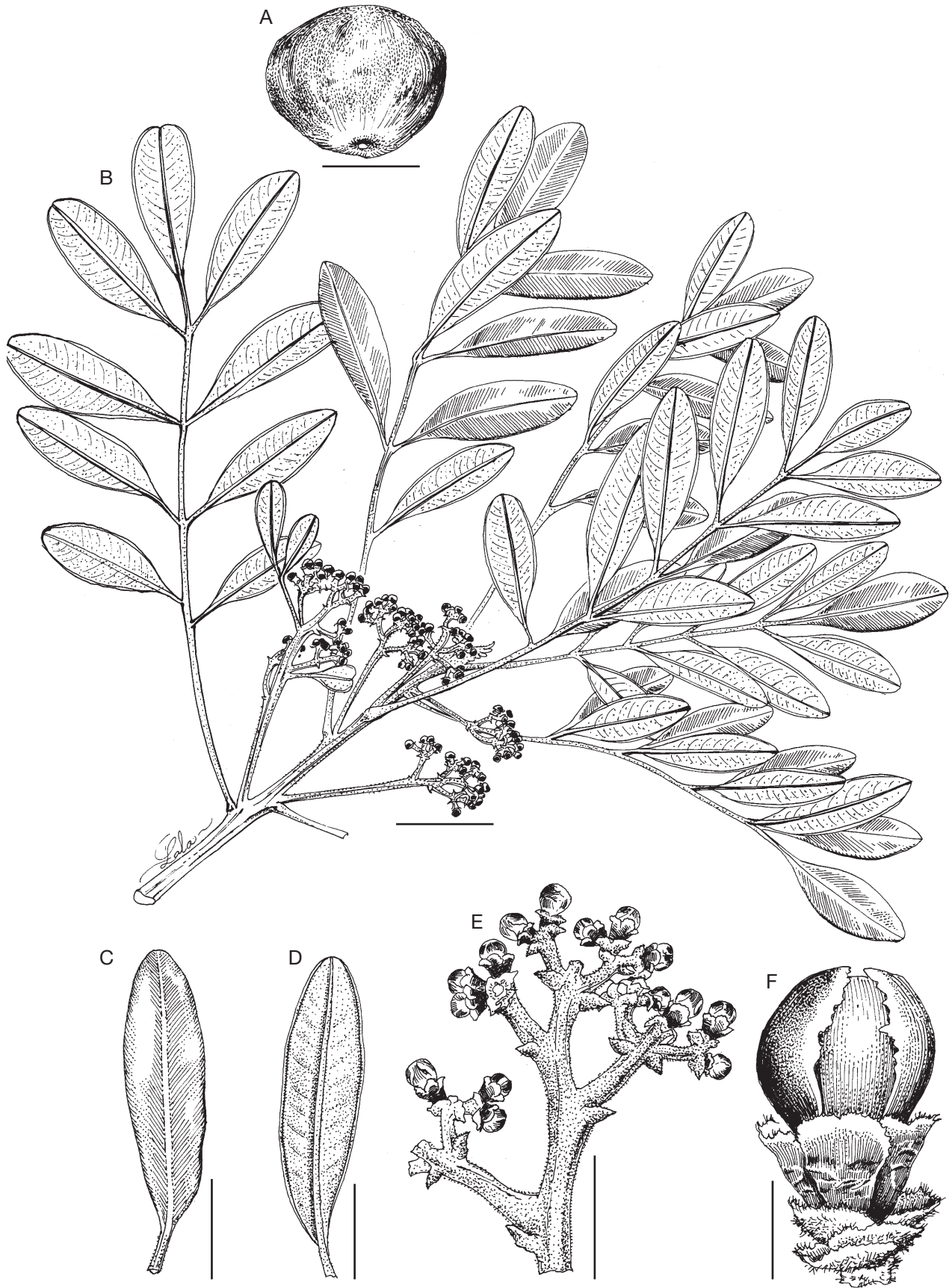


FIG. 1. — *Astrotrichilia leroyana*, sp. nov.: **A**, fruit; **B**, branch and inflorescence; **C**, adaxial leaf surface; **D**, abaxial leaf surface; **E**, inflorescence; **F**, flower; **A**, *R. Guittou et al.* 185; **B-F**, *D. K. Harder et al.* 1670. Drawn by Roger Lala Andriamiarisoa. Scale bars: A, C-E, 1 cm; B, 2 cm; F, 1 mm.



FIG. 2. — *Astrotrichilia leroyana*, sp. nov.: **A**, habit and inflorescence; **B**, habit and mature flower; **C-D**, habit and mature fruits. **A**, L. Nusbaumer 1159; **B**, L. Gautier *et al.* 4563; **C**, L. Gautier *et al.* 4507; **D**, P. Ranirison 732. Photographs by Louis Nusbaumer (**A**), Laurent Gautier (**B**, **C**), and Patrick Ranirison (**D**). © Conservatoire et Jardin botaniques de la Ville de Genève.

used in plant names, means resin or sticky sap in both the Sakalava and Merina languages (J. Razafitsalama and L. Andriamahefarivo, pers. comm.). Given the overall vegetative similarity of the two, the Malagasy informant for the *Guittou et al.* 185 collection may have mistaken the *Astrotrichilia* for *C. faho*.

Harinantenaina *et al.* (2011) conducted a bioassay for potentially medicinally useful compounds obtained from ethanol extractions of *Astrotrichilia leroyana*, sp. nov. The compound astrotricoumarin was isolated from dried stem tissue (represented by the voucher *S. Rakotonandrasana et al.* 1091) and showed anti-proliferative properties in an ovarian cancer cell line.

DESCRIPTION

Shrub or tree to 11 m high; stem to 30 cm in diameter, bark blackish; young stems grayish to light brown, finely striated, moderately to densely covered in a fine stellate-tomentum. Leaves 8-15 × 4-9 cm, imparipinnate or sometimes paripinnate, leaflets in 3 to 5 pairs alternate to subopposite, rachis sparsely to moderately stellate-tomentose with hairs like those of the stem; petiole 2-4.5 cm long, moderately to densely stellate-tomentose, canaliculate; rachis sparsely to moderately stellate-tomentose, canaliculate; petiolule 0.2-0.5 cm long, moderately to densely stellate-tomentose, canaliculate. Leaflets oblanceolate to oval-el-

liptic, coriaceous, 1.5-5 × 0.7-2 cm, base attenuate-cuneate, weakly asymmetric, margin entire, subrevolute, apex rounded, retuse to emarginate; venation pinnate, eucamptodromous, with 4-10 pairs of secondary veins, somewhat visible on both surfaces, tertiary venation not visible on either surface; abaxial surface moderately to densely stellate-tomentose, drying beige, the primary vein densely stellate-tomentose, prominent; adaxial surface glabrous, shiny, deep green *in vivo*, drying dark brown, the primary vein sparsely to densely stellate-tomentose becoming glabrous or more sparsely stellate-tomentose at maturity. Inflorescence an axillary thyse; peduncle 1.2-2.5 cm long, moderately to densely stellate-tomentose, articulated at the base, inflorescence 2-4.2 cm long, bearing up to *c.* 60 flowers, axes moderately to densely stellate-tomentose; pedicels 1-1.5 mm long, moderately to densely stellate-tomentose. Flowers ovoid, presumed to be functionally unisexual, isomorphic; sepals 5, fused at the base, broadly ovate to flabellate, 0.4-1 × 0.7-1.2 mm, weakly imbricate, apex obtuse, ciliolate, abaxial surface glabrous to moderately pubescent with short white trichomes, adaxial surface glabrous; petals 5, ovate to obovate, 1.3-3 × 1.2-2 mm, white to cream, apex rounded to obtuse,

margin entire to finely irregularly lacerate or ciliolate, glabrous; stamens 10, fused to form a staminal tube; tube cylindrical, membranaceous, 0.5–1.5 mm long, glabrous, summit of tube entire or sometimes lacerate, sinuate between anthers; anthers ellipsoid, 0.7–1 × 0.3–0.4 mm, sessile on summit of staminal tube or subsessile with filaments to 0.1 mm long; pistil 1.5–2 mm long; ovary ovoid, 0.5–0.8 mm tall, 0.6–1.2 mm in diam., glabrous, 4–5-locular, each locule with 1–2 ovules; style 0.3–0.6 × 0.3–0.6 mm, glabrous; stigma discoid, 0.3–0.4 mm tall, 0.6–0.9 mm in diam., glabrous, apex truncate. Fruit a hard, woody drupe, globose to slightly depressed-globose, 1.3–1.5 cm tall, 1.6–2 cm in diameter, glabrous, drying dark brown, with 2–5 locules developing. Seeds lenticular-reniform, 6–7 × 8–9 mm, brown, surface glabrous, foveolate.

REMARKS

In their unpublished treatment of the Meliaceae in Madagascar, Leroy and Lescot surmised that flowers in *Astrotrichilia* are functionally unisexual. They state that antherodes can be differentiated from fertile anthers by their slightly smaller size, resinous surface, lanceolate shape, indehiscence, and sterile pollen that is deformed or absent. Similarly, the pistillode might be distinguished from a fertile pistil by its smaller size and nonfunctional ovules (Leroy & Lescot unpubl. data). However, based on careful scrutiny of all available flowering specimens of *A. leroyana*, sp. nov., as well as comparisons to *A. asterotricha*, we have not been able to identify any consistent differences between flowers that may be functionally male or female. Perhaps it is the range of sizes due to developmental stage or variability among individuals that preclude the differentiation between anthers and antherodes, and pistils and pistillodes. Indeed, according to Mabberley (2011), “[...] it is often difficult, in the absence of field studies, to ascertain the true sexual arrangements of any particular species [in the Meliaceae].” A fuller and more accurate characterization of sexual systems based on field studies is needed for *Astrotrichilia*, and it seems that, at least for *A. leroyana*, sp. nov., it may not be possible to identify functionally male or female flowers using herbarium material alone.

CONSERVATION STATUS

Astrotrichilia leroyana, sp. nov. is known from only 13 collections from lowland dry forest remnants in northern Madagascar where it is threatened by habitat degradation due primarily to bushfires and overgrazing. These threats are particularly severe in dry forests outside of the protected area network at five separate locations (*sensu* IUCN 2012) including Sahafary. Four other locations for the species are situated within the Loky-Manambato Protected Landscape, where the threats are less severe. With an EOO of < 2000 km², an AOO of < 100 km² and nine locations, four of which are situated within the Loky-Manambato Protected Landscape, *Astrotrichilia leroyana*, sp. nov. is assigned a preliminary status of “Vulnerable” [VU B1ab(iii)+2ab(iii)] following IUCN Red List Categories and Criteria (IUCN 2012). The available habitat of the species is threatened and is expected to diminish in the future, even if some of these forests are part of a newly designated protected area.

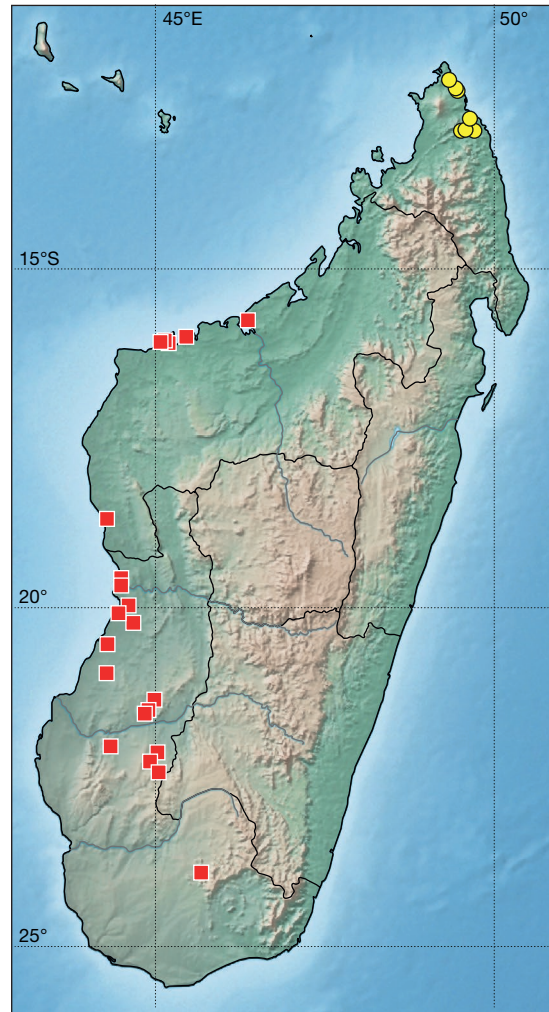


Fig. 3. — Geographic distribution of *Astrotrichilia leroyana*, sp. nov. (●) and *A. asterotricha* (Radlk.) Cheek (■) in Madagascar.

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