



# Four new species of *Acalypha* L. (Euphorbiaceae, Acalyphoideae) from Madagascar, with notes about their conservation status

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## ABSTRACT

Four new species of *Acalypha*, subgen. *Acalypha* (Euphorbiaceae, Acalyphoideae) from Madagascar are described, illustrated, and mapped. *Acalypha ankaranensis* sp. nov. is found in the Ankarana massif, in a dry deciduous forest at 180 m elevation; *A. cardielii* sp. nov. in the Tsingy de Bemaraha, also associated to dry deciduous forest, at 360 m elevation; *A. magistri* sp. nov. in the Marojejy Natural Reserve, in evergreen moist forest at 1583 m elevation, and *A. levinii* sp. nov. in the southern sclerophyllous woodland between 140 to 990 m elevation. These new species are quite well characterized morphologically and ecologically and are easily differentiated from morphologically similar ones. *A. ankaranensis* and *A. levinii* are most similar to *A. paxii* Aug.DC., a common species in northern Madagascar, *A. cardielii* is close to *A. leptomyura* Baill., and *A. magistri* is close to *A. chibomboia* Baill. According to our preliminary conservation assessments, *A. ankaranensis* and *A. cardielii* are Critically Endangered, *A. levinii* is Endangered, and *A. magistri* is Vulnerable.

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## 1. Introduction

This paper continues the revisionary work on *Acalypha* L. for the West Indian Ocean Region (including Madagascar, Comoros, Mascarene Islands, Seychelles, and Scattered Islands) that was begun by Montero-Muñoz et al. (2018a, 2018b, 2020a, 2020b).

*Acalypha*, with around 500 species, is the third largest genus in the family Euphorbiaceae, after *Euphorbia* L. (Riina et al., 2013) and *Croton* L. (Berry et al., 2005). About 65 species are estimated to grow in continental Africa (Cardiel and Montero-Muñoz, 2018), and 44 species were previously known from the West Indian Ocean Region, 35 of them from Madagascar, mostly endemic (Montero-Muñoz et al., in prep).

According to the infrageneric treatment of Pax and Hoffman (1924), *Acalypha* is divided into three subgenera: *Acalypha*, *Linostachys* (Klotzsch ex Schltdl.) Pax & K.Hoffm. and *Androcephala* Pax & K.Hoffm.; only in Madagascar are all three present (Montero Muñoz et al., 2018b). The Malagasy *Acalypha* species are mainly deciduous or evergreen shrubs, shrubs, or small trees; their leaves are simple, alternate, petiolate, and stipulate. The inflorescences can be terminal or axillary, unisexual or bisexual. The flowers are unisexual and apetalous; the male flowers are minute and similar in all species, and female flowers present feathery styles that are usually bright red. The

fruits are capsular, usually 3-lobed, and covered by a variety of trichomes that are useful to distinguish species. In *Acalypha*, another type of female flower is frequently found, named “allomorphic”; they are very different from the usual flowers. The allomorphic flowers usually have long pedicels, are rarely subsessile, ebracteate, with 5 sepals, and generally have 1-lobed ovaries (Radcliffe-Smith, 1973). They could appear like aborted flowers, but they are fertile, producing viable seeds. We have found these flowers in some Malagasy species, including three described here.

The Malagasy species belonging to subgenus *Acalypha*, present spicate inflorescences, terminal, or axillary, unisexual or bisexual; the bisexual inflorescences present male flowers grouped above the female flowers (androgynous); the female flowers are sessile, with 3 sepals, and are subtended by bracts that increase in size as the fruit develops. The single Malagasy species of subgenus *Linostachys*, *A. baretiae* I.Montero & Cardiel, presents racemose inflorescences, axillary and bisexual, and the bisexual inflorescences has female flowers grouped above the male flowers (gynecandrous); the female flowers are pedicellate, with 5 sepals, and minute bracts, not enlarging in the fruit which is 2-lobed.

The single known species of subgenus *Androcephala*, *A. diminuta* Baill., endemic to Madagascar, also present inflorescences that are racemose, androgynous, with the male segment umbelliform; the female flowers are pedicellate, with 5 sepals, and minute bracts not enlarging in fruit.

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*Acalypha* species in Madagascar grow in a wide variety of habitats, from the evergreen humid forest to deciduous, dry, forest and scrublands, and from sea level to 2500 m above sea level.

## 2. Materials and methods

The taxonomic description of the new species is based on morphological, geographical, and ecological data. The descriptions and illustrations provided are based in specimens deposited in the following herbaria: BR, CAN, E, G, ILLS, K, LMU, MA, MAUAM, MO, P, PRE, TAN, and WAG (acronyms follow Thiers, 2021). Specimens seen by the authors are indicated with an exclamation mark (!). Herbarium accession numbers are included when known. Specimens were studied using a dissecting microscope. Information about habit, plant size, and habitat is based on field notes on the specimen labels. The distribution maps were prepared using QGIS Desktop 3.2.2. Conservation assessments are based on the IUCN Red List Categories and Criteria (IUCN, 2012, 2017). Area of occupancy (AOO) and extent of occurrence (EOO) were calculated using GeoCAT, a geospatial conservation assessment tool (Bachman et al., 2011; <http://geocat.kew.org/>), using a 2 × 2 km grid cell size as recommended by IUCN (2012, 2017).

Taxonomic and biogeographical information about *Acalypha* is available online on the regularly updated *Acalypha Taxonomic Information System* website (Cardiel et al., 2021; [www.acalypha.es](http://www.acalypha.es)).

## 3. Taxonomic treatment

***Acalypha ankaranensis*** I.Montero & Cardiel, **sp. nov.** Type: Madagascar: Diana region [Antsiranana prov.]: Ambilobe, Réserve Spéciale d'Ankarana. Piste vers le campement des Anglais et la sortie de la réserve [Track to the English camp and the exit of the reserve], 180 m, 12°54'43" S 49°06'39" E, 19 Feb 1994. M. Andrianarisata, B. Lewis, J. McDonagh, P. J. Rakotomalaza, F. Andriatsiferana, O. Andrianantoanina & D. Ravelonarivo 41 (P [P00508496] Holo.!; MO [MO-2965838] Iso.!). Fig. 1.

**Diagnosis:** *Acalypha ankaranensis* I.Montero & Cardiel is morphologically similar to *A. paxii* Aug.DC., but differs from it mainly by having leaf blades to 9 cm long, membranous, with rounded to cordate base and acuminate apex (vs. leaf blades to 16 (–22) cm long, sub-chartaceous, with rounded to obtuse base and caudate apex), stipules to 5 mm long, with simple and glandular trichomes (vs. stipules to 10 mm long, with only simple trichomes), and female bracts reniform, with simple trichomes, and with bracteoles (vs. female bracts triangular to elliptic, with simple and minute glandular trichomes, without bracteoles).

**Description:** Shrubs, probably deciduous, to 1.2 m tall, monoecious. Branches slender, red-tinged. Young branches pubescent, with simple, curved, antrorse trichomes; mature branches glabrescent. Axillary buds ovoid, c. 1 mm long, perulate, perules 2, overlapping (superposed), membranous, scarious, appressed-pubescent and with sessile glands at margin. Stipules c. 5 mm long, lanceolate to linear-lanceolate, apex acute, sparsely hairy with simple, short trichomes, margin with simple, erect trichomes c. 1.5 mm long and short, glandular trichomes. Petioles reddish, 3–5 cm long, indumentum similar to that found on the young branches but also with simple, erect trichomes c. 1.5 mm long. Leaf blades (6–)7–9 × 3.5–5.5 cm, broadly ovate-lanceolate, membranous; base rounded to cordate; apex acuminate, acumen to 2 cm long, acute; margin serrate, teeth acute with sessile glands at apex; upper surface laxly pubescent, with simple, erect trichomes c. 1.5 mm long and simple, curved trichomes on veins; lower surface laxly pubescent with sparse, simple, short trichomes and simple, curved trichomes on veins, axils of the secondary veins with pocket-shaped domatia; venation prominent on both surfaces, actinodromous, basal veins 5, secondary veins 5–6 per side. Stipels filiform, c. 1 mm long, sparsely hairy. Inflorescences androgynous and, with solitary female bracts, mainly axillary, some

androgynous inflorescences terminal. Androgynous inflorescences spiciform, sessile or subsessile, to 5.5 cm long, mostly male with a short female segment at base; rachis with indumentum similar to that found on the petioles. Male segment persistent, to 4 cm long, with a sterile segment to 2 cm long, flowers glomerate; bracts c. 0.8 mm long, oblong, sparsely hairy. Female segment to 3.5 cm long, with 1–4 bracts; bracts sessile, enlarging in fruit c. 8 × 10 (–18) mm, reniform, sparsely hairy with simple, erect trichomes c. 1 mm long, mainly at margin; margin dentate to denticulate, with c. 14 teeth, teeth acute to subacute, with sessile glands at apex, central tooth not prominent; bracteoles minute, c. 0.5 mm long, lanceolate, sparsely hairy. Solitary female bracts similar to those found on the androgynous inflorescences. Male flowers with pedicel c. 0.5 mm long, sparsely hairy; buds c. 0.8 mm diameter, sparsely hairy, papillose. Female flowers 1 per bract, sessile; sepals 3, c. 0.7 mm long, triangular, sparsely hairy, margin with some sessile glands; ovary c. 1 mm diameter, 3-lobed, hispid, with simple, erect trichomes c. 1.5 mm long; styles 3, c. 6 mm long, slightly connate at base, sparsely hairy on rachis, each divided into c. 10 slender segments. Allomorphic flowers sometimes present, axillary, solitary; pedicel filiform, to 2 cm long, sparsely hairy; mature ovaries not seen. Capsules c. 3 mm diameter, papillose-hispid (papillae conical, c. 0.5 mm long, ending in a simple trichome c. 1 mm long) and pubescent with simple, short trichomes. Seeds subglobose, apiculate, c. 1.2 mm diameter, foveolate.

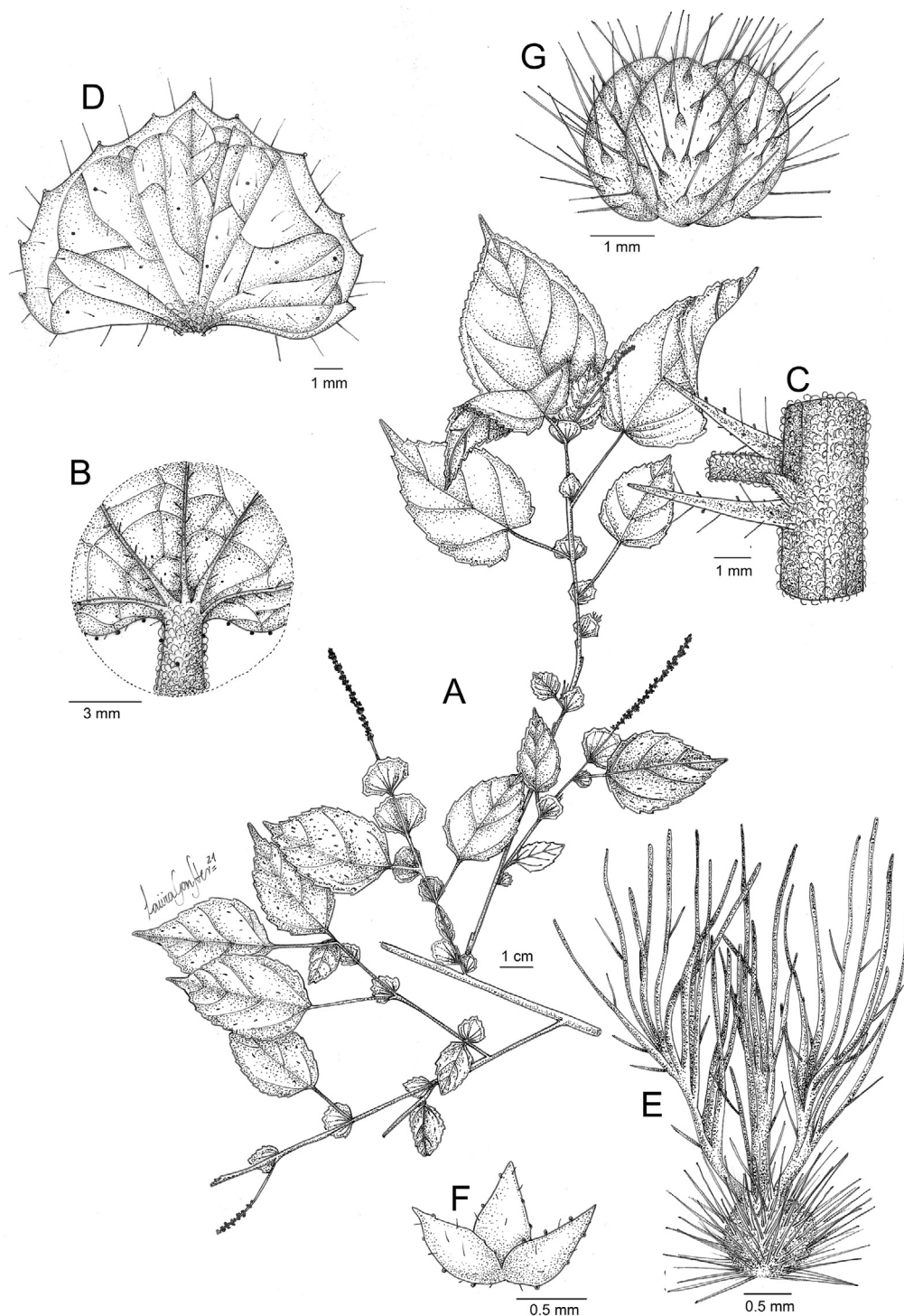
**Etymology:** The epithet refers to the Ankarana massif (Madagascar), to which this species may be endemic.

**Distribution and habitat:** Endemic to Madagascar (Diana region), Ankarana massif. Dry deciduous forest on Mesozoic limestones. Elevation c. 180 m (Fig. 5).

**Conservation assessment:** *Acalypha ankaranensis* is only known from the Ankarana massif, where this species appears to be a narrow endemic. The extent of occurrence (EOO) and the area of occupancy (AOO) are estimated to be 12 km<sup>2</sup>. The Ankarana massif is a Special Reserve, established in 1956, and a category IV protected area (Dudley, 2008). The reserve lost 20% of its dry deciduous forests and 85% of its moist evergreen forest from 1996 to 2016 and is threatened mainly by sapphire mining, and, to a lesser extent, by agriculture (commercial cash crop), logging, and locally by fires to improve grazing (Wilson et al., 1988; Kull, 2000; Goodman et al., 2018). In recognition of its restricted geographic range and the cited threats, *A. ankaranensis* is assigned a preliminary IUCN conservation status of Critically Endangered: CR B1ab(ii,iii,iv).

**Additional specimens examined (paratypes):** Madagascar, Diana region [Antsiranana prov.]: Mahamasina. Réserve Spéciale d'Ankarana, chemin du canyon forestier [forest canyon path], 130 m, 12° 55'25" S 49°06'39"E, 16 Jan 2003. M. Bardot-Vaucoulon & al. 1209 (K!, MO!, P [P00455503!], TAN); Ankarana Res., near Campement des Anglais, 150 m, 12°54'S 49°08'E, 30 Jan 1994, A. J. M. Leeuwenberg, O. Andrianantoanina & S. Rapanarivo 14374 14374 (BR [BR0000021450266!], E, G!, K!, LMU, MA!, MO!, P [P04779850!], PRE, TAN, WAG).

**Notes.** Among the Malagasy species, *Acalypha ankaranensis* is most similar to *A. paxii* Aug.DC., a common species in northern Madagascar. Differences between these two species are outlined in the above diagnosis. *A. ankaranensis* can be also confused with *A. urophylla* Boivin ex Baill., a species widely distributed in Madagascar, but absent from the Ankarana massif). *Acalypha ankaranensis* differs from *A. urophylla* mainly by having petioles reddish, inflorescences axillary and terminal, with 1–4 female bracts at base, and female bracts to 8 × 10 (–18) mm, with two bracteoles at the base. By contrast, *Acalypha urophylla* has petioles greenish, inflorescences only axillary, with a single female bract at base, and female bracts to 4 (–6) × 5.5 (–7) mm, without bracteoles. In the Ankarana massif, *Acalypha chibomboia*, *A. leptomyra*, *A. menavody*, *A. rabesaharana*, *A. rottleroides*, *A. spachiana*, and *A. tremula* are also found. *Acalypha ankaranensis* could be confused with *A. leptomyra* and *A. tremula*



**Fig. 1.** *Acalypha ankaranensis*. A. Flowering branch. B. Detail of lower leaf surface and petiole base. C. Detail of node, stipules, and petiole base. D. Mature female bract. E. Ovary and styles. F. Calyx of the female flower. G. Capsule. Based on A. J. M. Leeuwenberg, & al. 14374 (A, E–G), M. Bardot-Vaucoulon 1209 (B–D). Illustration by Laura González Hernández.

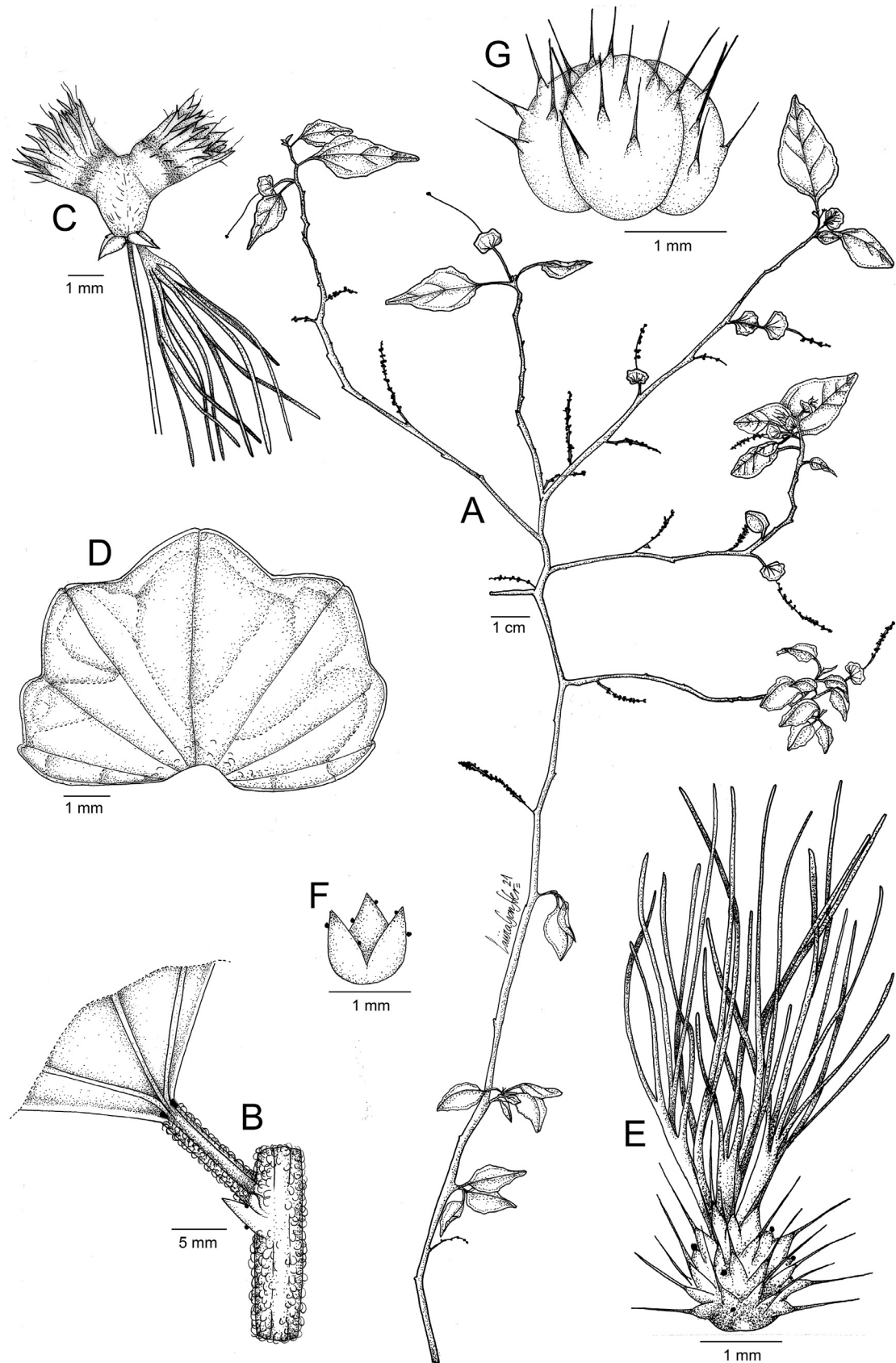
but can be distinguished from them mainly by its leaves, female bracts, and capsules.

***Acalypha cardielii*** I. Montero & G.A. Levin, **sp. nov.** Type: Madagascar. Melaky region (Mahajanga prov.): Tsingy du Bemaraha, 1932–1933, J. Leandri 115 (P [P00887484] Holo.; P [P05547055] Iso.). Fig. 2.

**Diagnosis:** *Acalypha cardielii* I. Montero & G.A. Levin is morphologically similar to *A. leptomyura* Baill., but differs from it mainly by having petioles canaliculate (vs. petioles not canaliculate), leaf blades

subrhombic, with acute base and obtuse to retuse apex (vs. leaf blades ovate-lanceolate to subtriangular, with obtuse to truncate base and subacuminate apex), and androgynous inflorescences, pedunculate, with 2 female bracts at base (vs. androgynous inflorescences sessile, with 1 female bract at base).

**Description:** Shrubs, probably deciduous, height unknown, monoecious. Branches slender, whitish. Young branches pubescent with simple, curved, antrorse trichomes; mature branches glabrescent. Axillary buds spherical, c. 1 mm diameter, perulate, perules 2,



**Fig. 2.** *Acalypha cardielii*. A. Flowering branch. B. Detail of node, stipules, petiole base, and leaf blade. C. Detail of allomorphic female flower. D. Mature female bract. E. Mature ovary and styles. F. Calyx of the female flower. G. Capsule. Based on J. Leandri 115. Illustration by Laura González Hernández.



imbricate, chartaceous, glabrous. *Stipules* c. 1 mm long, triangular-lanceolate, apex acute, sparsely hairy, with simple, short trichomes and some sessile glands at margin. *Petioles* slender, canaliculate, 0.5–1.5(–2) cm long, indumentum similar to that found on the young branches. *Leaf blades* 1.8–2.6(–3) × 1.1–1.6 cm, subrhombic, membranous; *base* acute; *apex* obtuse to retuse; *margin* crenate-serrate, revolute, reddish, teeth rounded; *upper surface* sparsely hairy with some sparse, simple, short trichomes; *lower surface* glabrous; venation actinodromous, basal veins 3, secondary veins 3–4 per side. *Stipels* minute, glandular, c. 0.2 mm long, glabrous. *Inflorescences* androgynous and male, axillary. *Androgynous inflorescences* spiciform, to 5.5 cm long, mostly male with a short female segment at base; peduncle to 1.5 cm long, it and rachis with indumentum similar to that found on the petiole. *Male segment* persistent, to 2.5 cm long, flowers glomerate; *bracts* c. 1 mm long, elliptic-lanceolate, glabrous. *Female segment* to 2.5 cm long, with 2 bracts; *bracts* sessile, enlarging in fruit c. 8 × 6 mm, reniform, glabrous; margin crenate, with c. 6–12 teeth, teeth rounded; *bracteoles* absent. *Male inflorescences* subsessile, peduncle c. 0.3 mm long; to 3.5 cm long, laxly flowered. *Male flowers* with pedicel c. 0.5 mm long, sparsely hairy; buds c. 0.5 mm diameter, glabrous. *Female flowers* 1 per bract, sessile; *sepals* 3, c. 1 mm long, triangular-lanceolate, glabrous, with some sessile glands at margin; *ovary* c. 1 mm diameter, 3-lobed, papillose-hispid (papillae acute, ending with a simple trichomes c. 0.5 mm long) and with some subsessile glandular trichomes; *styles* 3, c. 4 mm long, distinct at base, glabrous, each divided into c. 7–9 segments. *Allomorphic flowers* sometimes present at apex of the androgynous inflorescences; pedicel filiform, to 1.5 cm long, glabrous; *sepals* 3, similar to those found on regular flowers; *ovary* 1-lobed, c. 2 × 1.5 mm, sparsely hairy, distally fimbriate; *style* 1, c. 4 mm long, glabrous. *Capsules* c. 2 mm diameter, papillose-hispid, with conical papillae ending in a simple trichome to 1 mm long, otherwise glabrous. *Seeds* not seen.

**Etymology:** We dedicate this species to Dr. José María Cardiel, co-director of the first author's PhD dissertation and the second author's esteemed colleague. Dr. Cardiel is one of the world's leading experts on *Acalypha*, especially in New World species, describing to date more than 30 new species of the genus.

**Distribution and habitat:** Endemic to Madagascar (Melaky region). Dry deciduous forest. On limestone. Elevation c. 360 m (Fig. 5).

**Conservation assessment:** *Acalypha cardielii* is only known from one collection from the Tsingy de Bemaraha. The extent of occurrence (EOO) could not be calculated. Its area of occupancy (AOO) is estimated to be 4 km<sup>2</sup>. The Tsingy de Bemaraha lies within a national park and a nature reserve that have been IUCN category II and Ia protected areas since 1927 and a UNESCO World Heritage Site since 1990. The forest in this area has local anthropogenic pressures such as fire associated with the renewal of zebu (cattle) pastures, logging for construction, and deforestation for new agricultural lands, resulting in loss of forest cover during the last decade (Dudley, 2008; Goodman et al., 2018). No specimens of this species have been collected for 88 years, so we cannot rule out this species having become extinct. In conclusion, due to habitat loss, the restricted geographic range, and the absence of recent collections, *A. cardielii* is assigned a preliminary IUCN conservation status of Critically Endangered: CR B2ab(ii,iii) (possibly EX).

**Notes.** *Acalypha cardielii* is most similar to *A. leptomyra* Baill., which is widely distributed in western and central Madagascar. See the differences between these two species in the above diagnosis. Tsingys, the habitat of *A. cardielii*, are endemic-rich karstic formations characteristic of Madagascar. Among *Acalypha* species, others closely associated with tsingys are *A. ankaranensis*, *A. leandrii*, and *A. rabesahalana*, none of which closely resembles *A. cardielii*.

***Acalypha levinii*** I.Montero & Cardiel **sp. nov.** Type: Madagascar. Haute Matsiatra region (Fianarantsoa prov.): Parc d'Anja Community Reserve, E of RN7, ca. 9.5 km of Ambalavao, 990 m, 21°51'7.5" S 46°

50'43.1"E, 29 Nov 2012, L. J. Gillespie, G. A. Levin & J. Razanatsoa 19809 (CAN, Holo.!; MO, P, TAN, Iso!). Fig. 3.

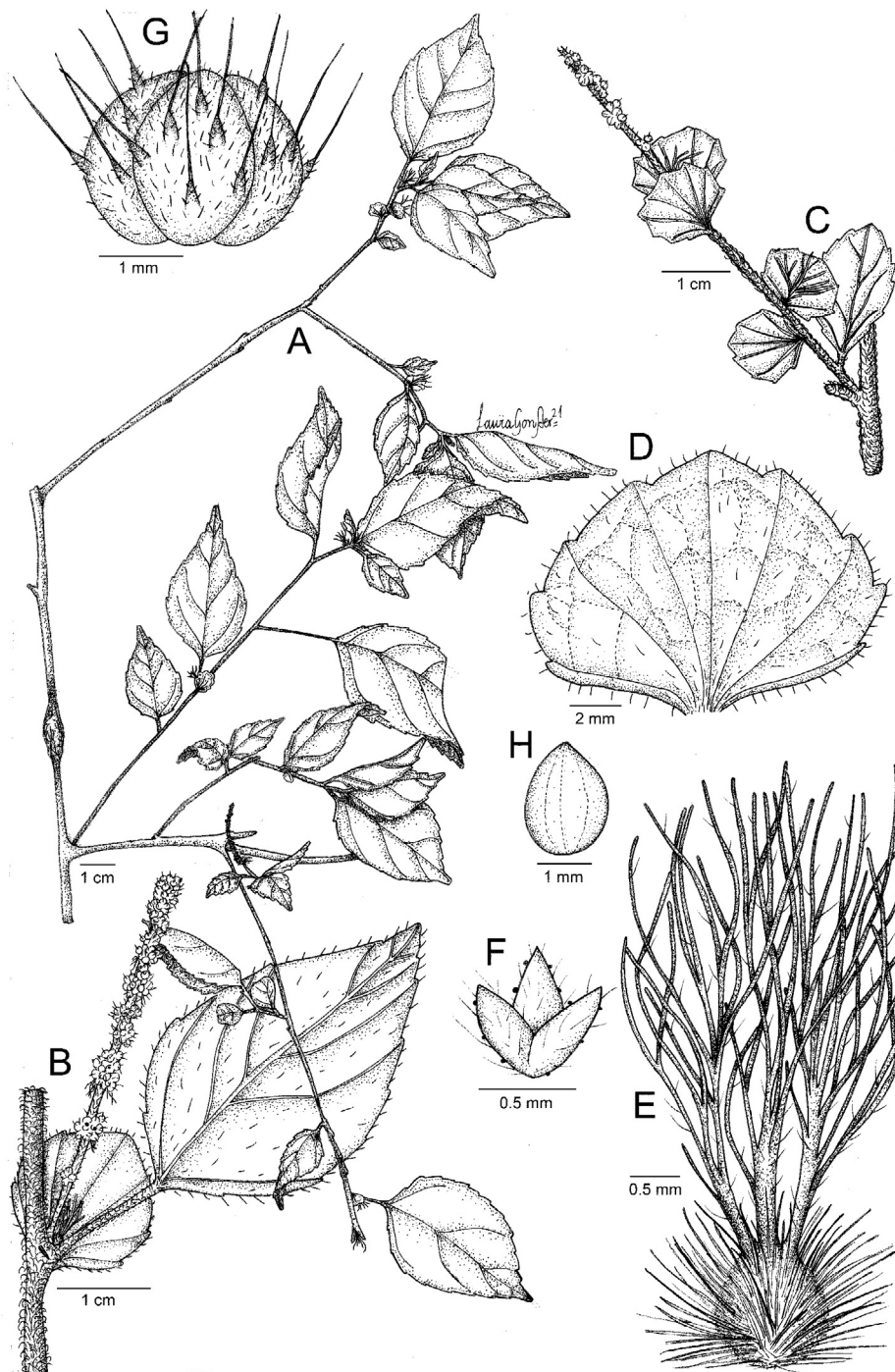
**Diagnosis:** *Acalypha levinii* I.Montero & Cardiel is morphologically similar to *A. paxii* Aug.DC., but differs from it mainly by having leaf blades to 6.5 cm long, membranous, with slightly acuminate apex, and with simple and glandular trichomes (vs. leaf blades to 16(–22) cm long, subchartaceous, with caudate apex, and with only simple trichomes), stipules c. 4 mm long, with simple, appressed trichomes (vs. stipules c. 10 mm long, with simple, patent trichomes) and female bracts oblate to subrounded, without prominent central tooth (vs. female bracts triangular to elliptic, usually with prominent central tooth).

**Description:** Shrubs, deciduous, to 2 m tall, monoecious. *Branches* slender, divaricate, red-tinged. *Young branches* densely pubescent, with simple, curved, antrorse trichomes; *mature branches* glabrescent. *Axillary buds* spherical, c. 1 mm diameter, perulate, perules 2, overlapping (superposed), membranous, glabrous. *Stipules* c. 4 mm long, lanceolate, apex acute, pubescent, with simple, appressed trichomes. *Petioles* 1.5–3(–4) cm long, indumentum similar to that found on the young branches. *Leaf blades* (3.5–)4–6.5 × 2–3.3 cm, ovate-lanceolate to elliptic-lanceolate, membranous; *base* rounded to subcordate; *apex* slightly acuminate, acumen rounded to subacute, mucronate; *margin* serrate to crenate, teeth subrounded, slightly reddish, callose-edged; *upper surface* laxly pubescent, with simple, erect trichomes and subsessile reddish glandular trichomes; *lower surface* with indumentum similar to that found on the upper surface but more dense, axils of the secondary veins with hair-tuft domatia; venation actinodromous, basal veins 3, secondary veins 5–6 per side. *Stipels* minute, filiform, c. 0.3 mm long, glabrous. *Inflorescences* androgynous and solitary female bracts, mainly axillary, some androgynous inflorescences terminal. *Androgynous inflorescences* spiciform, subsessile, peduncle c. 0.3 mm long; to 4 cm long, mostly male with a short female segment at the base; rachis with indumentum similar to that found on the petiole. *Male segment* persistent, to 2 cm long, flowers glomerate; *bracts* c. 0.5 mm long, lanceolate, sparsely hairy. *Female segment* to 2.5 cm long, with 1–4 bracts; *bracts* sessile, enlarging in fruit to 10 × 12 mm, oblate to subrounded, slightly pedunculate, with indumentum similar to that found on the leaves, glabrescent; margin dentate, with c. 15 teeth, teeth triangular, ciliate, subacute, callose-edged, slightly reddish; *bracteoles* absent. *Solitary female bracts* similar to those found on the androgynous inflorescences. *Male flowers* with pedicel c. 0.5 mm long, sparsely hairy; buds c. 0.8 mm diameter, sparsely hairy, papillose. *Female flowers* 1 per bract, sessile; *sepals* 3, c. 0.5 mm long, triangular, sparsely hairy; *ovary* c. 1 mm diameter, 3-lobed, hispid, with erect, simple trichomes c. 1 mm long; *styles* 3, c. 4 mm long, slightly connate at base, sparsely hairy at base, each divided into c. 12 segments. *Allomorphic flowers* sometimes present at apex of the inflorescence; pedicel filiform, to 1.2 cm long, sparsely hairy; *sepals* 3, similar to those of normal flowers; *ovary* 1-lobed, c. 1 mm diameter, hispid, with simple, erect trichomes to 1 mm long; *style* 1, c. 6 mm long. *Capsules* c. 2.5 mm diameter, papillose-hispid (papillae conical, c. 0.4 mm long, ending in a simple trichome to 1.3 mm long) and densely pubescent with simple trichomes. *Seeds* subglobose, c. 1.8 × 1.5 mm, foveolate.

**Etymology:** We dedicate this species to Dr. Geoffrey A. Levin, co-director of the first author's PhD dissertation and the third author's esteemed colleague. Dr. Levin is one of the main experts on the genus *Acalypha* worldwide, focusing on its phylogeny and evolution. Dr. Levin is one of the collectors of the type specimen of this species.

**Distribution and habitat:** Endemic to Madagascar (Atsimo-Andrefana and Haute Matsiatra regions). Secondary sclerophyllous woodland and gallery forests. On basement rocks and sandstones. Altitudinal range 140–990 m (Fig. 5).

**Conservation assessment:** *Acalypha levinii* is known from four collections from three different localities. The extent of occurrence (EOO) of *Acalypha levinii* is estimated to be 12,578 km<sup>2</sup>, and its area



**Fig. 3.** *Acalypha levinii*. A. Flowering branch. B. Detail of node, stipules, leaf, and axillary inflorescence. C. Detail of the terminal inflorescence. D. Mature female bract. E. Ovary and styles. F. Calyx of the female flower. G. Capsule. H. Seed. Based on L. J. Gillespie, G. A. Levin & J. Razanatosoa 10808 (A), L. J. Gillespie, G. A. Levin & J. Razanatosoa 10809 (B–H). Illustration by Laura Gonzalez Hernandez.

of occupancy (AOO) 16 km<sup>2</sup>, which is less than the 500 km<sup>2</sup> threshold of the B2 subcriterion of the Endangered category. This species grows mainly in sclerophyllous woodland, which have mainly been converted to secondary grasslands by human activities such as fires for agriculture or cattle grazing (Kull, 2003; Gautier et al., 2018). This species was collected mainly in degraded forests. The habitat of this species is subject to threat, especially from uncontrolled fires for grazing and crops, so ongoing loss of its habitat will induce a continued decline of its EOO and AOO. *Acalypha levinii* is assessed as Endangered (EN): EN B2ab(ii,iii,iv).

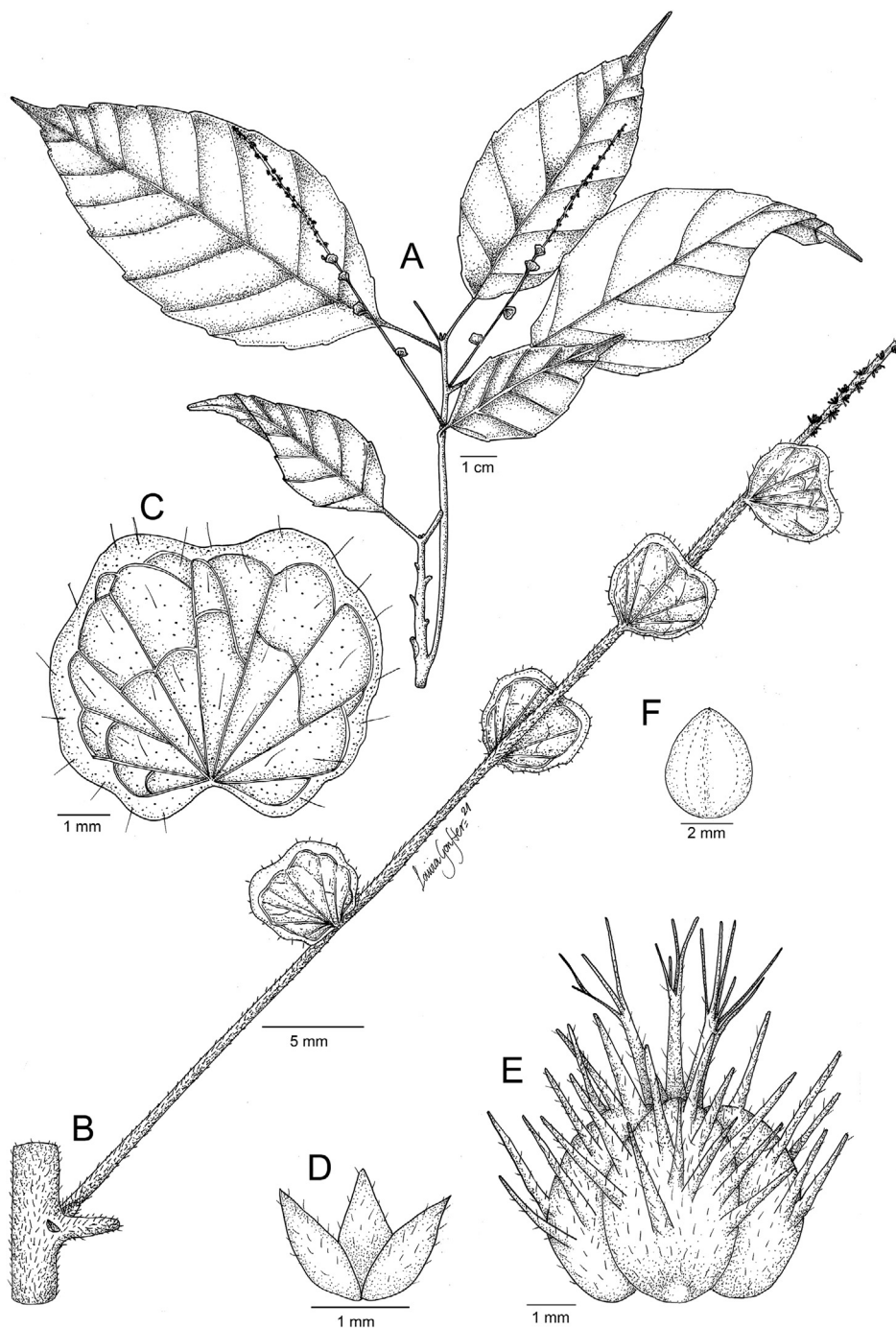
*Additional specimens examined (paratypes):* Madagascar. Haute Matsiatra region (Fianarantsoa prov.): Haute Matsiatra. Parc d'Anja Community Reserve, E of RN7, ca. 9.5 km of Ambalavao, 990 m, 21° 51'6.1" S 46°50'43.7"E, 29 Nov 2012, L. J. Gillespie, G. A. Levin & J. Razanatosoa 19808 (CAN!, ILLS!, MO!, TAN!); Atsimo-Andrefana region (Toliara prov.): Beza Mahafaly Reserve, near Betioky. Parcelle 1. Along the Sakamena river bank, 140 m, 23°38'60" S 44°32'60"E, 2 Nov 1987, P.B. Phillipson 2503 (K!, MO!, WAG); Atsimo-Andrefana region (Toliara prov.): Plateau calcaire au N de las bassevallée du Fiherenana, 200–300 m, Jan 1947, H. Humbert 19866 (P [P00324585!]).

**Notes.** *Acalypha levinii* also is most similar to *A. paxii* Aug.DC. See the differences between these two species in the above diagnosis. *Acalypha levinii* can be also confused with *A. urophylla* Boivin ex Baill., but differs from it mainly by having leaf surfaces with simple and glandular trichomes, lower leaf surface with hair-tuft domatia, and female bracts enlarging to  $10 \times 12$  mm, oblate to subrounded, with simple and glandular trichomes. By contrast, *Acalypha urophylla* has leaf surfaces with only simple trichomes, lower leaf surface without domatia, and female bracts enlarging to  $4(-6) \times 5.5(-7)$  mm, triangular to elliptic, with only simple trichomes. *Acalypha levinii* grows in sclerophyllous woodlands and gallery forests in central and

southwest Madagascar, where other species such as *A. leptomyura*, *A. radula*, *A. urophylla*, and *A. vulneraria* are found. Other than *Acalypha urophylla*, none of these species closely resembles *A. levinii*.

***Acalypha magistri*** I.Montero & Cardiel **sp. nov.** Type: Madagascar. Sava region (Antsiranana prov.): Au Nord d'Andapa, dans la Réserve Naturelle Intégrale de Marojejy, aux environs du sommet d'Ambatosoratra, 1583 m,  $14^{\circ}32'S$   $49^{\circ}42'E$ , 17–24 Jun 1994, D. Ravelonarivo 273 (MO, Holo.!; ILLS, MAUAM, P, TAN, Iso.!). [Fig. 4](#).

**Diagnosis:** *Acalypha magistri* I.Montero & Cardiel is morphologically similar to *A. chibomboia* Baill., but differs from it mainly by having the lower leaf surface, female bracts, and capsules with only



**Fig. 4.** *Acalypha magistri*. A. Flowering branch. B. Detail of node, stipules, petiole base, and inflorescence. C. Mature female bract. D. Calyx of the female flower. E. Capsule and mature styles. F. Seed. Based on D. Ravelonarivo 273. Illustration by Laura Gonzalez Hernandez.



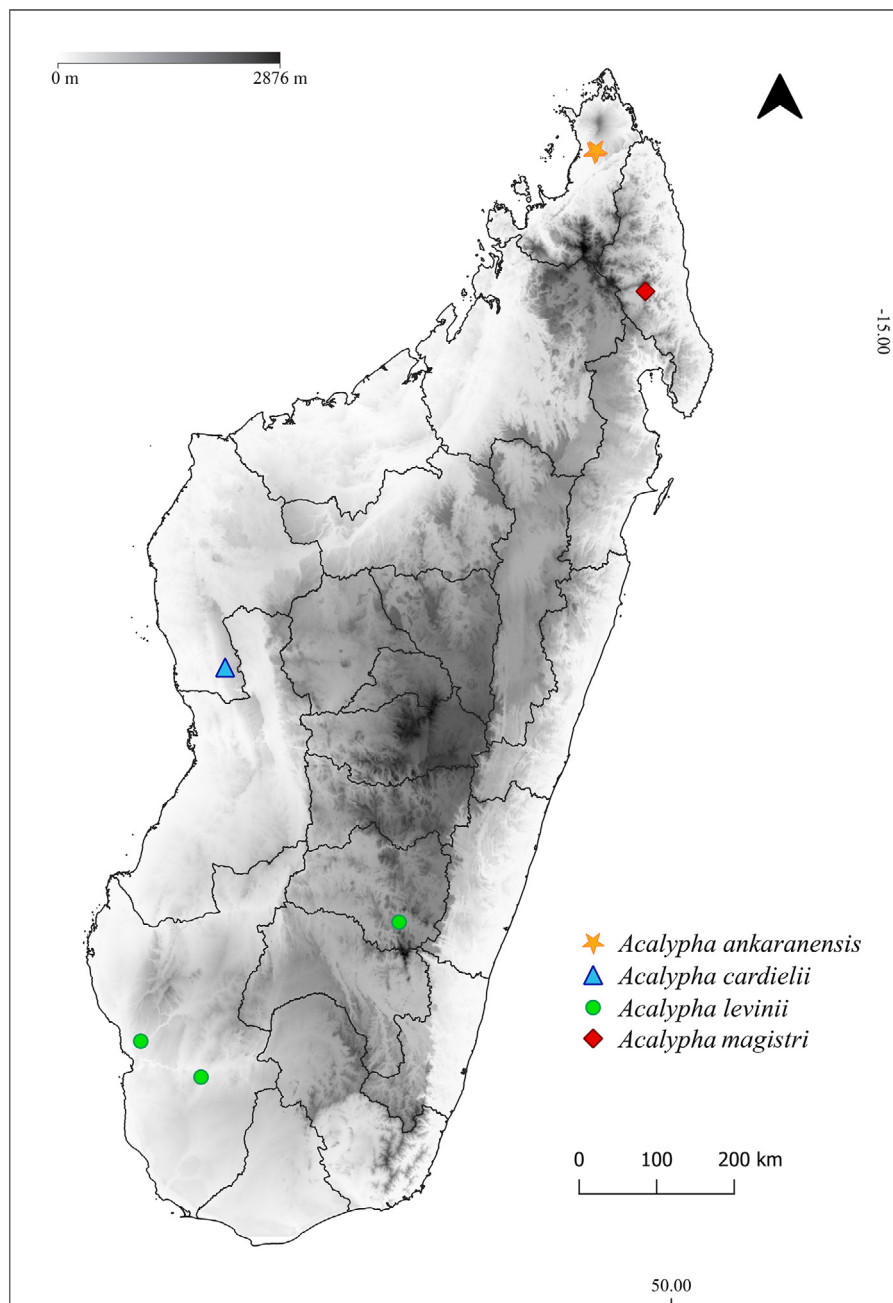


Fig. 5. Map of Madagascar showing distributions of *Acalypha ankaranensis*, *A. cardielii*, *A. levinii*, and *A. magistri*.

simple trichomes (vs. lower leaf surface, bracts, and capsules with simple trichomes and flattened resinous glands), and capsules echinate, with conical projections c. 2 mm long (vs. capsules smooth).

**Description:** Small trees, deciduous or evergreen, to 6 m tall, monoecious. *Young branches* pubescent, with simple, short, erect trichomes; *mature branches* glabrescent. *Axillary buds* ovoid, c.  $1.5 \times 0.7$  mm, perulate, perules 2, imbricate, chartaceous, glabrous. *Stipules* c. 2 mm long, triangular-lanceolate, apex acute, ciliate with simple, short trichomes and with some sparse, simple trichomes at base. *Petioles* 1.2–3.5 cm long, indumentum similar to that found on the young branches. *Leaf blades*  $7.5\text{--}12 \times 2\text{--}5.5$  cm, elliptic-lanceolate to ovate-lanceolate, subchartaceous; *base* rounded; *apex* acuminate, acumen to 1.3 cm long; *margin* serrate and ciliate, teeth acute; *upper surface* subglabrous, with simple, short, erect trichomes, especially on veins; *lower surface* with indumentum similar to that found on the upper surface but more densely covered; venation pinnate,

secondary veins 6–8 per side. *Stipels* absent. *Inflorescences* spiciform, androgynous, axillary, to 9.5 cm long, mostly male with a female segment at base; peduncle to 2.2 cm long, pubescent with simple, curved, antrorse trichomes; rachis with indumentum similar to that found on the peduncle. *Male segment* persistent, to 3.8 cm long, flowers glomerate; *bracts* c. 0.7 mm long, triangular, sparsely hairy. *Female segment* to 3.7 cm long, with 4 bracts; *bracts* sessile, enlarging in fruit c. 5 mm diameter, orbicular, pubescent with simple, erect trichomes c. 0.5 mm long; margin subentire to crenate; *bracteoles* absent. *Male flowers* with pedicel c. 0.5 mm long, sparsely hairy; buds not seen. *Female flowers* 1 per bract, sessile; *sepals* 3, c. 1.5 mm long, triangular-lanceolate, sparsely hairy; *ovary* not seen; *styles*, c. 3 mm long, sparsely hairy when old. *Allomorphic flowers* not seen. *Capsules* c. 5 mm diameter, echinate, with conical projections c. 2 mm long, pubescent with simple, short, erect trichomes. *Seeds* pyriform, c.  $4 \times 3$  mm, minutely foveolate.



**Etymology:** The epithet honours the teachers of the Alonso de Ercilla High School (Ocaña, Toledo, Spain), where the first author did her high school studies. Their teachings and support have been essential in her career.

**Distribution and habitat:** Endemic to Madagascar (Sava region). Marojejy Natural Reserve, near the summit of Ambatosoratra peak. Medium altitude evergreen moist forest. On basement rocks, 1583 m elevation (Fig. 5).

**Conservation assessment:** *Acalypha magistri* is only known from one collection from Marojejy Natural Reserve. The extent of occurrence (EOO) could not be calculated. Its area of occupancy (AOO) is estimated to be 8 km<sup>2</sup>. Marojejy has been a protected area since 1952 and a National Park since 1998 (Category II; Dudley, 2008). The main threats that affect the Marojejy forests are illegal logging of precious wood, out-of-control fires, and mining for topaz and beryl, mainly at the boundaries of the National Park. At high elevations, where this species occurs, the only current threat is ecotourism, which increases human visitation (Patel, 2007; Almeda and Ranarivelo, 2019). This species was collected near the top of Ambatosoratra peak so it is presumed that its habitat is not greatly affected. In view of its limited area of occupancy *Acalypha magistri* is assigned a preliminary IUCN conservation status of Vulnerable: VU D2.

**Notes.** *Acalypha magistri* is most similar to *A. chibomboia* Baill., known from the dry forests of the Diana region and Comoros Archipelago. The differences between these two species are noted in the above diagnosis. *Acalypha magistri* is a montane species found in Marojejy Natural Reserve, where *A. emirnsensis* and *A. urophylla* are also found. *Acalypha magistri* can be easily distinguished from these two species because *A. emirnsensis* has unisexual inflorescences (vs. androgynous in *A. magistri*), and *A. urophylla* has smaller leaves than *A. magistri* (5–7.5 cm long vs. 7.5–12 cm long in *A. magistri*) and sessile inflorescences with one female bract at base (vs. pedunculate inflorescences with four female bracts in *A. magistri*).

#### 4. Discussion

The new species described belong to *Acalypha* subg. *Acalypha*, which includes more than 90% of the members of the genus. The new species are quite distinct from the most morphologically similar known, and they are also well characterized from ecological perspective.

Including the new species described here, the total amount of the Malagasy species increases to 39, 12 of which have been discovered in the last four years, during our revisionary work, and all of them were found stored in herbaria. Additional potentially new species are still under study. The previous revisionary work of *Acalypha* in Madagascar was carried out almost 80 years ago (Leandri, 1942); this study includes 23 species, 19 of them currently accepted. These facts highlight the importance of botanical collections, and the need to update the taxonomic information, especially in highly threatened territories such as Madagascar. According to our preliminary conservation assessments, all the new species described here are included in some threat category (two of them are Critically Endangered, although they are found in protected areas). Additional collection effort is still needed to clarify the conservation status of these newly described species. Our aim is also to draw attention to the importance of the habitats where these species live and provide reasons for their conservation. As Wood et al. (2017) said, a nameless plant cannot be catalogued or red-listed, and the threats to its existence cannot be assessed.

#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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