Transfer of the Malagasy genera Humbertianthus and Macrostelia to Hibiscus (Malvaceae) with description of four new species

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Abstract

HANES, M.M., G.E. SCHATZ & M.W. CALLMANDER (2020). Transfer of the Malagasy genera Humbertianthus and Macrostelia to Hibiscus (Malvaceae) with description of four new species. *Candollea* 75: 193–202. In English, English and French abstracts. DOI: http://dx.doi.org/10.15553/c2020v752a4

Two Malagasy species of the genus *Macrostelia* Hochr. (*Malvaceae*) are transferred to *Hibiscus* L. and two new combinations are proposed: *Hibiscus calyculatus* (Hochr.) M. Hanes, G.E. Schatz & Callm. and *Hibiscus involucratus* (Hochr.) M. Hanes & G.E. Schatz & Callm. The monotypic genus *Humbertianthus* Hochr. with its single species *Humbertianthus cardiostegius* Hochr. was defined as a taxon in its bud stage and represented unopened flowering collections of *Hibiscus laurinus* Baill. Several recent herbarium collections from the eastern humid forest of Madagascar represent four new restricted range species: *Hibiscus ambanitazensis* M. Hanes & G.E. Schatz, *Hibiscus analalavensis* M. Hanes & G.E. Schatz, *Hibiscus ankeranensis* M. Hanes & G.E. Schatz, *Hibiscus vohipahensis* M. Hanes & G.E. Schatz. Each of the new species are documented by field photographs and their geographic distribution is presented. Risk of extinction assessments of the seven species discussed indicate three taxa are threatened as "Critically Endangered", and four are "Least concern".

Résumé

HANES, M.M., G.E. SCHATZ & M.W. CALLMANDER (2020). Transferts des genres endémiques de Madagascar Humbertianthus et Macrostelia à Hibiscus (Malvaceae) et description de quatre nouvelles espèces. *Candollea* 75: 193–202. En anglais, résumés anglais et français. DOI: http://dx.doi.org/10.15553/c2020v752a4

Deux espèces malgaches du genre *Macrostelia* Hochr. (*Malvaceae*) sont transférées à *Hibiscus* L. et deux nouvelles combinaisons sont proposées: *Hibiscus calyculatus* (Hochr.) M. Hanes, G.E. Schatz & Callm. et *Hibiscus involucratus* (Hochr.) M. Hanes & G.E. Schatz & Callm. Le genre monotypique *Humbertianthus* Hochr. avec son unique espèce *Humbertianthus cardiostegius* Hochr. a été défini comme un taxon dans sa forme en bourgeon et représente des collections de fleur non ouvertes d'*Hibiscus laurinus* Baill. Plusieurs collections récentes d'herbiers provenant de forêt dense humide de l'Est de Madagascar représentent quatre nouvelles espèces à aire de répartition restreinte: *Hibiscus ambanitazensis* M. Hanes & G.E. Schatz, *Hibiscus analalavensis* M. Hanes & G.E. Schatz, *Hibiscus ankeranensis* M. Hanes & G.E. Schatz, *Hibiscus vohipahensis* M. Hanes & G.E. Schatz. Chacune des nouvelles espèces est documentée par des photographies de terrain et leur répartition géographique est présentée. Les évaluations des risques d'extinction des sept espèces examinées indiquent que trois taxons sont menacés comme «En danger critique» et quatre en «Préoccupation mineure».

Keywords

MALVACEAE – *Hibiscus* – *Humbertianthus* – *Macrostelia* – Madagascar – New synonyms – Nomenclature – New species

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Submitted on February 2, 2020. Accepted on August 20, 2020. First published online on October 29, 2020.

ISSN: 0373-2967 – Online ISSN: 2235-3658 – *Candollea* 75(2): 193–202 (2020) © CONSERVATOIRE ET JARDIN BOTANIQUES DE GENÈVE 2020

Introduction

Tribe *Hibisceae* Rchb. has 102 species known from Madagascar including 65 described species in the genus *Hibiscus* L. and members attributed to at least ten other genera (Madagascar Catalogue, 2020). Furthermore, *Hibiscus* itself is not monophyletic (Pfeil & Crisp, 2005) and several Malagasy endemic genera are embedded in *Hibiscus* (Koopman & Baum, 2008). The present work focuses on the genus *Macrostelia* Hochr. which was described by Hochreutiner (1952) to accommodate collections in family *Malvaceae* from Madagascar with the unique combination of entire, pinnately-veined leaves and pendent flowers with petals proximally fused into a tube. Two species, *Macrostelia calyculata* Hochr. and *M. involucrata* Hochr., were described from escarpment forests of the east coast of Madagascar. A third taxon, *M. laurina* (Baill.) Hochr. & Humbert, was transferred from *Hibiscus* L. to *Macrostelia* three years later (Hochreutiner, 1955) because it shared these unusual characteristics. The geographic range of *Macrostelia* was extended to Australia in 1974 with the description and recognition of *M. grandifolia* Fryxell (Fryxell, 1974).

Koopman & Baum (2008) constructed a molecular phylogeny exploring *Hibisceae* on Madagascar and used *Macrostelia laurina* as a placeholder for Malagasy species of *Macrostelia*. They demonstrated that the genus belongs in the *Euhibiscus* clade, an unranked clade name in *Hibiscus* as defined by Koopman & Baum (2008). Notably *Euhibiscus* includes the type of *Hibiscus* (*H. syriacus* L.) suggesting that members of *Macrostelia* are better placed in the genus *Hibiscus*. Furthermore, there is ample molecular evidence that the Malagasy species of *Macrostelia* are more closely related to other *Hibiscus* from Madagascar rather than to Australian taxa formerly included in *Macrostelia* (Fryxell, 1974; Craven & Pfeil, 2004; Koopman & Baum, 2008). Craven & Pfeil (2004) previously transferred all Australian members of *Macrostelia* to *Hibiscus*.

Hochreutiner (1948) further established the monotypic genus *Humbertianthus* Hochr. to accommodate a new taxon from eastern Madagascar that appeared to possess a suite of characters entirely novel and unique in the tribe *Hibisceae*. The presence of five geniculate style branches with convergent capitate stigmas, a severely reduced staminal column, and petals that are not fused with the staminal column differentiated *Humbertianthus* from all other genera in *Malvaceae*. We believe that *H. cardiostegius* Hochr. was defined as a taxon in its bud stage and that the Hochreutiner's descriptions were not measured from mature, open flowers. Thus, we propose that collections previously attributed to *H. cardiostegius*, instead, possess unopened flowers of *Hibiscus laurinus* from the low altitude rainforest of Betampona.

In response to the evidence presented above, we propose to transfer all currently described *Macrostelia* species on Madagascar to *Hibiscus* in accordance with morphology, phylogenetic understanding of *Hibiscus* on Madagascar (Koopman & Baum, 2008) and the generic delimitation of *Hibiscus* (Pfeil & Crisp, 2005). We also consider *Humbertianthus cardiostegius* Hochr. as a synonym of *Hibiscus laurinus*.

Several collections from the east coast of Madagascar previously determined as *H.* aff. *laurinus* due to the unusual combination of glabrous (or nearly so) leaves with entire margins and large, axillary, solitary and pendent flowers represent new restricted species from the eastern humid forest of Madagascar. These specimens form the basis of the four new species described below.

Each of the seven species treated here are provided with notes on their morphological affinities, a distribution map, and risk of extinction assessments following the IUCN Red List Categories and Criteria (IUCN, 2012). Calculations of Extent of Occurrence (EOO) and Area of Occupancy (AOO) have been conducted with Geocat (Bachmann & Moat, 2012). Lectotypes are also designated for two species: *Hibiscus laurinus* and *Humbertianthus cardiostegius*.

Transfer of Humbertianthus and Macrostelia to Hibiscus

Hibiscus calyculatus (Hochr.) M. Hanes, G.E. Schatz & Callm., **comb. nov.** (Fig. 1A).

≡ *Macrostelia calyculata* Hochr. in Notul. Syst. (Paris) 14: 232. 1952.

Holotypus: Madagascar. Reg. Haute Matsiatra [Prov. Fianarantsoa]: vallée Ampamaherana, [21°19'S 47°19'E], [1300 m], 25.V.1949, fl., *Service Forestier 2046* (P [P00037125]!; iso-: G [G00014441]!, TEF).

Vernacular name. – "Tsilaitra" (*Service Forestier 2046, 14420*).

Distribution and ecology. – *Hibiscus calyculatus* grows in medium elevation moist evergreen forests east of Fianarantsoa, in the massif of Andrambovato, in the Ampamaherana valley and near Kianjavato (D. Scherberich, pers. comm.) from 1155–1300 m in elevation (Fig. 2).

Conservation status. – *Hibiscus calyculatus* is known from 3 locations all encompassed in the Protected Area Network (Corridor Forestier Ambositra-Vondrozo and Ranofanana). Despite the very restricted Extent of Occurrence (EOO) of 12 km^2 and an Area of Occupancy (AOO) of 8 km^2, there appear to be no current threats to *H. calyculatus*. Thus, the species is assigned a conservation status of "Least Concern" [LC] using the IUCN Red List Categories and Criteria (IUCN, 2012), with the caution that this status is highly dependent on continued effective protection.



Fig. 1. – Photographs of flowers of *Hibiscus* L. **A.** *Hibiscus calyculatus* (Hochr.) M. Hanes, G.E. Schatz & Callm.; **B.** *Hibiscus laurinus* Baill.; **C.** *Hibiscus ambanitazensis* M. Hanes & G.E. Schatz.
[**B:** *Rasoandriana 89*; **C:** *J. Razanatsoa 644*] [Photos: **A:** D. Scherberich; **B:** P. Antilahimena; **C:** B. Mashburn]

Notes. – *Hibiscus calyculatus* is distinguished from all other pendent *Hibiscus* on Madagascar by its four small (3–4 mm), free, reflexed epicalyx bracts and a distinctive red, tubular calyx.

Additional specimens examined. – Madagascar. **Reg. Vatovavy-Fitovinany [Prov. Fianarantsoa]:** Massif d'Andrambovato, Tolongoina, Ikongo, 21°30'58"S 47°25'36"E, 1155 m, 28.V.1998, fl., *Razafimandimbison 335* (G, MO, P, TAN, TEX); Fort Carnot, Andrambovato Station Forestier, Parcelle A-16, [21°31'S 47°25'E], 28.VII.1954, fl., *Service Forestier 14420* (P, TEF).

Hibiscus involucratus (Hochr.) M. Hanes, G.E. Schatz & Callm., **comb. nov.**

≡ *Macrostelia involucrata* Hochr. in Notul. Syst. (Paris) 14: 230. 1952.

Holotypus: Madagascar. Reg. Atsimo-Atsinanana [Prov. Fianarantsoa]: Vondrozo, [22°49'S 47°19'E], 11.IX.1926, fl., *Decary 5257* (P [P00037126]!; iso-: G [G00014442]!, P [P00365083, P00037127]!, TEF).

Distribution and ecology. – *Hibiscus involucratus* is known from the low elevation tropical evergreen forests around Vondrozo at c. 450 m elevation (Fig. 2).

Conservation status. – *Hibiscus involucratus* is known only from a single location near Vondrozo, collected in 1926. It is possible that the collection has been made in what is now known as the Ambositra-Vondrozo protected area. With a single collection in the low elevation moist evergreen forests, which are highly threatened in Madagascar, this species is assigned a conservation status of "Critically Endangered" [CR B2ab(iii)] using the IUCN Red List Categories and Criteria (IUCN, 2012).

Notes. – *Hibiscus involucratus* can be distinguished from all other pendent *Hibiscus* in Madagascar by its tubular epicalyx with 6 irregular teeth that completely hides the calyx.

We consider the sheet [P00037126] as the holotype, as it is the only specimen with Hochreutiner's handwriting in P.

Hibiscus laurinus Baill. in Bull. Soc. Linn. Paris 1: 512: 1885 (Fig. 1B).

≡ *Macrostelia laurina* (Baill.) Hochr. & Humbert in Hochr., Fl. Madagascar Comores 129: 120. 1955.

Lectotypus (designated here): Madagascar. **Reg. Alaotra-Mangoro [Prov. Toamasina]:** "Manahar", [NE of Lac Aloatra], 12.V.1882, fl., *Humblot 241* (P [P00037128]!; iso-: G [G00017097, G00017098]!, K [K000240701] image seen, P [P00037129, P00365086]!).

= *Humbertianthus cardiostegius* Hochr. in Bull. Mus. Natl. Hist. Nat. 20: 476. 1948. **Lectotypus** (designated here): Madagascar. **Reg. Atsinanana [Prov. Toamasina]:** Betampona RNI, 19.I.1937, fl., *Réserves Naturelles 74* (P [P00037130]!; iso-: G [G00014468]!, MO-6089629!, P [P0037131, P00389395]!, TAN), **syn. nov.**

Vernacular names. – "Hafotra Fotsy" (*Réserves Naturelles 74*); "Ombavy" (*Réserves Natuelles 108*, *Lehavana 243*); "Tanatanapotry" (*Réserves Naturelles 2484*).

Distribution and ecology. – *Hibiscus laurinus* has the widest distribution of all the east coast pendent *Hibiscus* species. *H. laurinus* is known from low elevation, moist evergreen forest northwest of Toamasina in the protected area of Betampona to west of Bemanevika in the forests of Makirovana and Farahanitra in the north (Fig. 2). *Hibiscus laurinus* grows from 100 to 1329 m in elevation.

Conservation status. – *Hibiscus laurinus* is relatively widespread in Madagascar and has a geographic range in the form of an extent of occurrence (EOO) of c. 10,248 km^2 and an area of occupancy (AOO) of 60 km^2. It occurs in the protected areas of Betampona, Makirovana Tsihomanaomby, and Masoala, and is found at a minimum of 15 locations. This species is therefore assessed as "Least Concern" [LC] using the IUCN Red List Categories and Criteria (IUCN, 2012).

Notes. – *Humbertianthus cardiostegius* and *Hibiscus laurinus* were both described as small, slender trees with entire, elliptic, reticulate to pinnately-veined, briefly petiolate leaves with similar leaf sizes (4–8 × 2.5–4 cm). All collections of *Humbertianthus cardiostegius* are limited to January and March, whereas *Hibiscus laurinus* has been collected in flower from March through October. Pedicels on both entities are covered with ferrigenous hairs. The buds of *H. laurinus* resemble those of *Humbertianthus cardiostegius*. Perianth descriptions of *H. cardiostegius* have smaller proportional measurements than *Hibiscus laurinus*; shorter sepals, 10 mm (vs 3 cm) and shorter petals, 5 mm (vs 4–5 cm). The convergent nature of the stigmas in *Humbertianthus cardiostegius,* as well as the extremely "reduced" staminal column appear to represent reproductive organs that have yet to differentiate and elongate. The stigmas in both taxa have very long, hairy style branches. The abaxial portions of petals in both taxa are covered in a coarse pubescence. Flowers of *Hibiscus laurinus* are a vibrant red whereas those of *Humbertianthus cardiostegius* have been noted in the literature to be white or pink. The first author visited Betampona in January 2005 and collected *Hibiscus laurinus* in bud (*Koopman 224*) which ranged in color from white to a brilliant red. Fruits from *Humbertianthus cardiostegius* were never described, though 2–3 ovules in 5 locules within a hirsute ovary have been described, these values are consistent with *Hibiscus laurinus*.

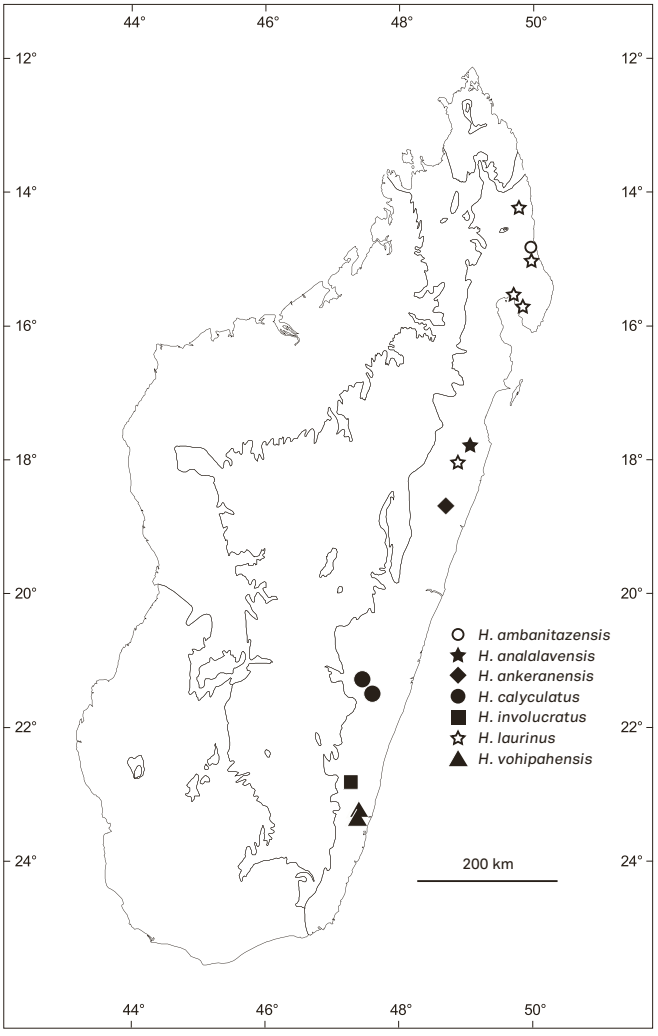


Fig. 2. – Known distribution of the seven species of *Hibiscus* L. highlighted in this paper.

Three type collections of both *Humbertianthus cardiostegius* and *Hibiscus laurinus* are extant at P (respectively *Réserves Naturelles 74* and *Humblot 241*). The most complete collections of each of the two names are designated here as lectotypes.

Additional specimens examined. – **Madagascar. Reg. Analanjirofo [Prov. Toamasina]:** Maroansetra, Anjahana, Ambanizana, 15°37'16"S 49°58'56"E, 200 m, 15.IX.2002, fl., *Antilahimena 1397* (MO, P); Mahalevona, 15°25'27"S 49°57'05"E, 975 m, 11.X.2003, fl., *Antilahimena 2187* (G, MO, P); Ambanizana, Masoala NP, 15°37'35"S 49°58'37"E, 249 m, 21.X.2004, fl., *Antilahimena 2920* (MO, P); c. 6 km NE d'Ambanizana, 600–700 m, 24.I.1996, fr., *Aridy 54* (MO, P, TAN); trail E of village of Hiaraka, toward the rock, ESE of Maroantsetra, 15°29'S 49°55'E, 275 m, 9.X.1986, fl., *Lowry 4028* (MO); presqu'île de Masoala, 15°38'S 49°58'E, 100 m, 9.XI.1994, fr., *Rabe 192* (MO, P, TAN); Ambanizana, 15°34'27"S 50°00'35"E, 1000 m, 24.VII.2000, bud, fl., *Rabenantoandro 229* (G, MO, P, TAN); Vohimarangitra, 20.I.1950, bud & fl., *Réserves Naturelles 2484* (P); Masoala Peninsula, Androanabe, 15°39'30"S 49°57'30"E, 0–600 m, 1.III.1992, fr., *Zjhara & Hutcheon 186* (MO, P); Masoala Peninsula, Androanabe, 15°39'30"S 49°57'30"E, 0–600 m, VI–VII.1993, *Zjhara & Hutcheon 357* (G, MO, P). **Reg. Atsinanana [Prov. Toamasina]:** Ambodiriana, Andratambe, 17°54'32"S 49°12'09"E, 469 m, 27.III.2009, fl. & fr., *Andriamiarinoro 186* (P); RNI Betampona, 210–410 m, 24.IV.1994, fl., *Andrianarisata 118* (MO, P); 3 km NW of Fotsimavo, camp at Rendrirendry, Betampona RNI, 17°55'49"S 49°12'12"E, 350 m, 19–26.III.1999, fl., *Birkinshaw 567* (MO, P, TAN), *ibid. loco,* 28.III.1941, fl., *Decary 16913* (P); *ibid. loco,* 23km NW Fotsimavo, 17°55'41"S 49°12'11"E, 1329 m, 13.I.2005, bud, *Koopman 224* (MO, P, TAN, WIS); *ibid. loco*, 17°54'56"S 49°12'16"E, 466 m, 29.I.2005, bud, *Lehavana et al. 243* (MO, P); *ibid. loco*, 17°55'15"S 49°12'01"E, 489 m, 8.III.2007, bud, fl., *Rakotoarivelo 36* (MO, P); Marovato, forêt d'Agnalahely, 17°53'13"S 49°14'13"E, 288 m, 5.III.2017, fl., *Rakotoarivelo 83* (K, MO, TAN); Belalimaitso, forêt de Menagisy, 17°55'25"S 49°19'41"E, 86 m, 11.III.2018, fl., *Rakotonirina 422* (MO, TAN); Fkt. d'Ampasina, Ampasimazava, forêt d'Amparafaravay, 17°56'27"S 49°20'09"E, 180 m, 12.III.2018, fl., *Rakotonirina 437* (K, MO, TAN); Fkt. d'Ampasina, forêt d'Alahambana, 17°54'49"S 49°19'05"E, 167 m, 12.III.2018, fl., *Rakotonirina 445* (MO, TAN); Fkt. d'Analamangahazo, village de Marovato, forêt d'Andriambôla, 17°53'05"S 49°13'54"E, 275 m, 9.III.2017, fl., *Rasoandriana 89* (K, MO, P, TAN); Betampona, I.1937, bud, *Réserves Naturelles 108* (G, P); *ibid. loco*, 17°55'S 49°13'E, 500 m, 5.IV.1989, fl., *Schatz 2684* (MO, P). **Reg. SAVA [Prov. Antsiranana]:** massif de Makirovana, 14°10'35"S 49°56'09"E, 546 m, 22.VIII.2007, fr., *Andriamihajarivo 1258* (MO, P); Antsahanivo-Ambodivapaza, forêt de Farahanitra, 14°09'16"S 49°55'26"E, 534 m, 13.VII.2013, fl. & fr., *Martial et al. 174* (MO, P); Makirovana, 14°10'00"S 49°57'01"E, 22.V.2009, bud & fl., *Raharimampionona 250* (MO, P, TAN, TEF); *ibid. loco*, 14°10'23"S 49°57'27"E, 324 m, 24.V.2009, fl., *Razakamalala 4346* (MO, P, TAN); *ibid. loco*, 14°09'50"S 49°57'09"E, 764 m, 6.V.2010, bud, *Razakamalala 5499* (MO, P, TAN); Antalaha-CR Vinanivao, CAP Masoala haute-vallée d'Anaovanandrano, 15°40'S 50°03'E, 390 m, 24.IX.2003, fl., *Wohlhauser et al. 634* (G, P).

New species

Hibiscus ambanitazensis M. Hanes & G.E. Schatz, **sp. nov.** (Fig. 1C).

Holotypus: Madagascar. Reg. Antsiranana [Prov. SAVA]: Com. Ampahana, Fkt. Andrapengy, Ambanitaza, 14°41'02"S 50°11'14"E, 9.XII.2015, fl., *Razanatsoa*, *Bernard & Mashburn 644* (MO-6710358!; iso-: P, TAN).

Hibiscus ambanitazensis M. Hanes & G.E. Schatz is distinct from all other reddish, pendent flowered Hibiscus from the east coast of Madagascar in its petal pigmentation (purple red), and the combination of a long pedicel (up to 42 mm), epicalyx bracts with 6 lobes (fused at the base), and calyx fused to at least half of length (fused for 7–11 mm).

Shrub c. 3.5 m tall, sparsely branched; twigs covered with golden, semi-erect, simple, fascicled and stellate trichomes. *Leaves* 5.5–9.8 × 2.8–4.6 cm, elliptic to narrowly obovate, the base acute to obtuse, apex acuminate, the acumen to 0.8 cm long, the tip rounded, glabrous above, very sparsely covered with golden stellate trichomes below, venation weakly brochidodromous with 8–10 secondary veins per side, midvein raised above and below, secondary veins slightly raised above and below, tertiary venation finely reticulate, slightly raised above and below; petiole 8–11 mm, c. 0.8 mm in diam., moderately densely covered with semi-appressed, curly, light golden

trichomes and occasional light golden stellate trichomes. *Flowers* solitary, axillary, pendent; pedicels 40–42 mm long, c. 0.8 mm in diam., densely covered with golden, erect, simple, fasciculate, and stellate trichomes; epicalyx with 6 lobes fused at the base for 3–4 mm of its length, the lobes 6 × 2.5–4 mm, ovate, the apex acute, densely covered with golden stellate trichomes on the outside, densely covered with golden appressed simple trichomes inside; calyx with 5 lobes, fused at the base for 7–11 mm, the lobes c. 15 × 10 mm, ovate to triangular, the apex narrowly triangular, very densely covered with golden stellate trichomes outside and inside; petals 5, 30 × 14 mm, obovate, the apex rounded, purple-red, strongly reflexed, densely covered with white stellate trichomes outside, glabrous and verrucose inside with visible venation; staminal column c. 21 mm long, c. 1.8 mm in diam., red, sparsely to moderately densely covered with light golden stellate trichomes, with a tuft of dense golden erect simple trichomes at the apex; stamens c. 70, filaments 8–10 mm long, red, anthers c. 1.3 × 1.3 mm; styles 5, 12–15 mm long, white, sparsely covered with white trichomes, stigma c. 0.8 mm in diam., urceolate. *Fruit* unknown.

Distribution and ecology. – *Hibiscus ambanitazensis* is known from one collection in a forest fragment on volcanic soil ("table basaltique") (Fig. 2).

Conservation status. – *Hibiscus ambanitazensis* is known only by a single location outside of the Protected Area Network in a small patch of forest north of Antalaha in close proximity to recent slash and burn activity. The "table basaltique" along the east coast of Masoala to north of Antalaha are highly threatened because their rich volcanic soils are highly suitable for agriculture. The new species is assigned a conservation status of "Critically Endangered" [CR B2ab(iii)] using the IUCN Red List Categories and Criteria (IUCN, 2012).

Notes. – The new species differs from all other reddish, pendent flowered *Hibiscus* from the east coast of Madagascar in its petal pigmentation, purple red (vs. red). Epicalyx, calyx and style color further distinguish *H. ambanitazensis* from *H. ankeranensis*, *H. calyculatus* and *H. laurinusus* (see Table 1).

Hibiscus analalavensis M. Hanes & G.E. Schatz, **sp. nov.** (Fig. 3A, 4A).

Holotypus: Madagascar. Reg. Atsinanana [Prov. Toamasina]: Analalava NP, 17°42'S 49°26'E, 16.XI.2007, fl., *Andriamiarinoro 102* (MO-6562524!; iso-: P [P00847913]!, TAN).

Hibiscus analalavensis M. Hanes & G.E. Schatz differs from H. vohipahensis M. Hanes & G.E. Schatz in having shorter petioles, 4–5 mm (vs. 6–10 mm), and shorter pedicels, 30–32 mm (vs. 45 mm).

Shrub to small tree 3–5 m tall, 3–4 cm dbh; twigs moderately densely covered with golden stellate trichomes. *Leaves* 7.3–11.9 × 3.3–5.1 cm, narrowly obovate, the base cuneate and abruptly attenuate, the margin strongly revolute, the apex

Table 1. – Comparison of morphological characters between the seven *Hibiscus* L. species highlighted here. Characters diagnostic for one species are in bold.

	H. ambanitazensis	*H. analalavensis*	*H. ankeranensis*	*H. calyculatus*	*H. involucratus*	*H. laurinus*	*H. vohipahensis*
Petiole length [mm]	8–11	4–5	3–5	2	2–3	variable	6–10
Pedicel length [mm]	40–42	30–32	7–15	5–8	10–15	45	45
Number of epicalyx bracts	6, unequal	5, unequal	5	4	tubular with 6 teeth, inflated	5–6	5, unequal
Epicalyx color	green	green	**green, succulent**	green to red	**covered in brown hairs**	**red**	green
Epicalyx reflexed?	no	no	no	**yes**	no	no	no
Calyx fusion	at least half of length	at least half of length	fused into a tube with small teeth	fused into a tube with small teeth, inflated	fused into a tube with small teeth	at least half of length	at least half of length
Calyx color	green	green	green	**red**	?	white to red	green
Corolla color	**purple red**	**white, blushed with pink**	red	red	red	red	**white**
Corolla reflexed?	yes/no	no	no	yes	no	yes	no
Style color	white	white	red	red	unknown	white to red	white



Fig. 3. – Photographs of flowers of *Hibiscus* L. **A.** *Hibiscus analalavensis* M. Hanes & G.E. Schatz; **B.** *Hibiscus ankeranensis* M. Hanes & G.E. Schatz; **C.** *Hibiscus vohipahensis* M. Hanes & G.E. Schatz. [**A:** *Ratovoson 2092*; **B:** *Antilahimena 7544*; **C:** *Razafitsalama 1409*] [Photos: **A:** F. Ratovoson; **B:** P. Antilahimena; **C:** C. Birkinshaw]

rounded to obtuse or slightly retuse, glabrous above, nearly completely glabrous below, venation brochidodromous with 6–7 secondary veins per side, midvein raised above and below, secondary veins slightly raised above and below, tertiary venation reticulate, slightly raised above and below; petiole 4–5 mm, c. 1 mm in diam., moderately densely covered with stellate trichomes. *Flowers* solitary, axillary, pendent; pedicels 30–32 mm long, 1.4 mm in diam., densely covered with reddish-gold, erect simple, fasciculate and stellate trichomes; epicalyx with 5 lobes fused at the base for 2 mm, the lobes 15 × 6–9 mm, broadly ovate, the apex acute, densely covered with rufous golden stellate trichomes on the outside, densely covered with golden appressed simple and fasciculate trichomes inside; calyx with 5 lobes, fused at the base for 6–9 mm (c. half of length), the lobes 20 × 18 mm, triangular, the apex triangular, very densely covered with golden stellate trichomes outside, very densely covered with appressed curly white trichomes inside; petals 5, 50 × 35–37 mm, obovate, the apex rounded, white with a peach blush, meanwhile they turn from pink to white with age, densely covered with light golden stellate trichomes outside, glabrous inside with evident venation; staminal column c. 30 mm long, c. 2 mm in diam., white, glabrous, with a tuft of dense, golden, erect, simple trichomes at the apex; stamens c. 70, filaments 10 mm long, white, anthers c. 1.5 × 1.5 mm; styles 5, c. 16 mm long, white, slender, moderately densely covered with white, erect, simple and fasciculate trichomes, stigma c. 0.5 × 0.8 mm, bulbous. *Fruit* unknown.

Vernacular names. – "Afopotsy" (*Lehavana 426*).

Distribution and ecology. – *Hibiscus analalavensis* occurs in the lowland moist evergreen forest of Analalava near Foulpointe from 40 to 90 m in elevation.

Conservation status. – *Hibiscus analalavensis* is known from 4 locations within the protected area of Analalava. Despite the very restricted extent of occurrence (EOO) (c. 1 km^2), there appear to be no current threats to *H. analalavensis*. Thus, the species is assigned a status of "Least Concern" [LC] using IUCN Red List Categories and Criteria (IUCN, 2012), with the caution that this status is highly dependent on continued effective protection.

Notes. – *Hibiscus analalavensis* resembles *H. vohipahensis* in that they have whitish flowers but differs from the latter species by having shorter petioles, 4–5 mm (vs. 6–10 mm), shorter pedicels, 30–32 mm (vs. 45 mm), and smaller petals, 15 × 6–9 mm (vs. 12–17 × 12–18 mm).

Paratypi. – Madagascar. **Reg. Atsinanana [Prov. Toamasina]:** Foulpointe, Morarano, forêt d'Analalava, à 7 km SW de Foulpointe, 17°42'05"S 49°27'31"E, 87 m, 12.II.2007, fl., *Lehavana 426* (MO, P, TAN); *ibid. loco*, 17°42'14"S 49°27'19"E, 40 m, 25.XI.2015, fl., *Ratovoson 2092* (MO, P, TAN); *ibid. loco*, 19.XII.1967, fl., *Service Forestier 28071* (P).

Hibiscus ankeranensis M. Hanes & G.E. Schatz, **sp. nov.** (Fig. 3B, 4B).

Holotypus: Madagascar. Reg. Atsinanana [Prov. Toamasina]: Dist. Brickaville, Com. Maroseranana, Fkt. Ambodilendemy, Andrangato river, Ankerana, 18°26'52"S 48°46'28"E, 346 m, 13.III.2011, fl., *Antilahimena 7544* (MO-2652132!; iso-: P [P06774026]!, TAN).

Hibiscus ankeranensis M. Hanes & G.E. Schatz differs from H. calyculatus (Hochr.) M. Hanes, G.E. Schatz & Callm. by its epicalyces, 5 non-symmetrical, succulent in vivo lobes (vs. 4 small, reflexed lobes), calyx color, green (vs. red), and its non-reflexed petals.

Tree c. 6 m tall, 12 cm dbh; twigs moderately densely covered with light, golden, semi-erect, simple, fascicled and stellate trichomes. *Leaves* 3.5–9.8 × 1.9–3.9 cm, elliptic to narrowly obovate, the base acute to obtuse, apex acuminate, the acumen to 1.2 cm, sometimes folded to one side, the tip rounded, glabrous and verruculose above, very sparsely covered with golden, stellate trichomes below, venation weakly brochidodromous with 7–10 secondary veins per side, with occasional intersecondary veins, midvein raised above and below, secondary veins slightly raised above and below, tertiary venation finely reticulate, slightly raised above and below; petiole 3–5 mm, 0.7–1 mm in diam., moderately densely covered with semi-appressed, curly light golden trichomes. *Flowers* solitary, axillary, pendent; pedicels 7–15 mm long, 0.2–0.7 mm in diam., densely covered with golden erect, simple and fasciculate trichomes; epicalyx with 5 free lobes, appearing somewhat succulent *in vivo*, the lobes 9 × 5–7 mm, ovate, the apex acute, sparsely covered with golden stellate trichomes on the outside, glabrous very sparsely covered with golden simple and stellate trichomes inside; calyx tubular with 4(–5?) lobes, fused for 5–7 mm, the lobes 2.5 × 2.5 mm, triangular, the apex triangular, moderately densely covered with golden stellate trichomes outside and inside; petals 5, 24 × 13 mm, obovate, the apex rounded to emarginate, red, sparsely covered with very light golden stellate trichomes outside, glabrous inside with evident venation; staminal column 20 mm long, 0.8 mm in diam., pinkish red, glabrous with very scattered minute trichomes; stamens 30–40(–50), filaments 8–10 mm, red, anthers 0.8 × 0.4 mm; styles 5, 8 mm, red, moderately densely covered with white trichomes, stigma c. 0.7 mm in diam., urceolate. *Fruit* unknown.

Distribution and ecology. – *Hibiscus ankeranensis* is known only from a single collection near the Andrangato river at Ankerana in the eastern coast of Madagascar at c. 350 m in elevation in lowland moist evergreen forests (Fig. 2).

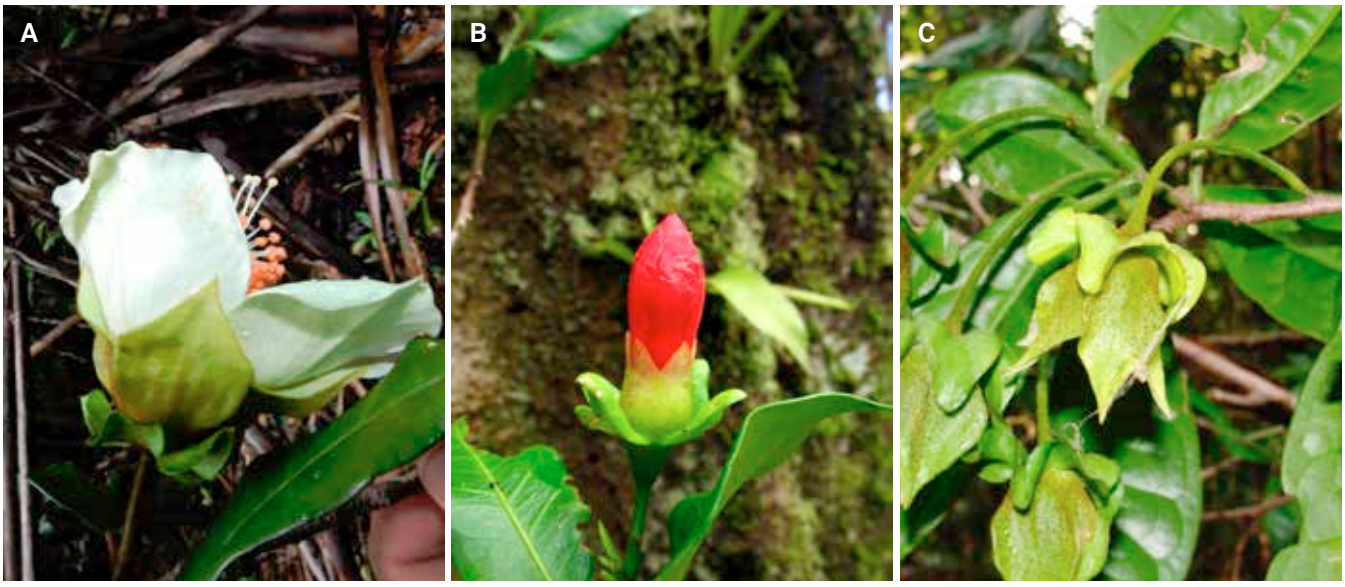


Fig. 4. – Photographs of epicalyx and calyx of *Hibiscus* L. **A.** *Hibiscus analalavensis* M. Hanes & G.E. Schatz; **B.** *Hibiscus ankeranensis* M. Hanes & G.E. Schatz; **C.** *Hibiscus vohipahensis* M. Hanes & G.E. Schatz. [**A:** *Ratovoson 2092*; **B:** *Antilahimena 7544*; **C:** *Razafitsalama 1409*] [Photos: **A:** F. Ratovoson; **B:** P. Antilahimena; **C:** C. Birkinshaw]

Conservation status. – *Hibiscus ankeranensis* is known only from a single collection from the newly designated Corridor Ankeniheny-Zahamena protected area. We lack information on population size but lowland moist evergreen forests (below 800 m) are fragmented and heavily deforested in the region (Gautier, 2018). Recent satellite imagery from Google earth [https://www.google.com/intl/en/earth] suggests that the collection site and the surrounding area is deforested or disturbed. *Hibiscus ankeranensis* is therefore assessed as "Critically Endangered" [CR B2ab(iii)] using IUCN Red List Categories and Criteria (IUCN, 2012).

Notes. – *Hibiscus ankeranensis* is similar to *H. calyculatus* in corolla color but differs by its epicalyces with 5 lobes, 9 mm long (vs. 4(–5) lobes, reflexed, 3–4 mm long), calyx with 4(–5) teeth, green, succulent in vivo (vs. 5 teeth, red, inflated) and petals not reflexed (vs. reflexed).

Hibiscus vohipahensis M. Hanes & G.E. Schatz, **sp. nov.** (Fig. 3C, 4C).

Holotypus: Madagascar. Reg. Atsimo-Atsinanana [Prov. Fianarantsoa]: Vangaindrano, Vohipaho, Ankara Bolava Forest, 23°31'34"S 47°30'01"E, 27 m, 26.VIII.2008, fl., *Bussmann 15177* (MO-6152851!; iso-: G [G00341945]!, P, TAN).

Hibiscus vohipahensis M. Hanes & G.E. Schatz differs from H. analalavensis M. Hanes & G.E. Schatz in having longer petioles and pedicels, large pure white petals that are widest at the apex with filaments about twice as long as the long staminal column.

Tree 3–6 m tall, 6 cm dbh; twigs covered with light golden stellate trichomes. *Leaves* 7.8–13.7 × 2.9–4.5 cm, narrowly obovate, the base acute, the margin strongly revolute, the apex acuminate, glabrous above, nearly glabrous below with the occasional stellate trichome below, venation brochidodromous with 8–10 secondary veins per side, midvein raised above and below, secondary veins slightly raised above and below, tertiary venation reticulate, slightly raised above and below; petiole 6–10 mm, 1 mm in diam., covered with stellate trichomes. *Flowers* solitary, axillary, pendent; pedicels 45 mm, 1.2 mm in diam., densely covered with golden, erect, simple, fasciculate and stellate trichomes; epicalyx with 5 lobes fused at the base for 2 mm, the lobes 12–17 × 12–18 mm, broadly ovate, the apex acute to obtuse, densely covered with golden stellate trichomes on the outside, densely covered with light golden, erect simple and fasciculate trichomes inside; calyx with 5 lobes, fused at the base for 12 mm (about half of length), the lobes 20 × 18 mm, ovate, the apex acute, densely covered with golden stellate trichomes outside, densely covered with appressed curly beige trichomes inside; petals 5, c. 55 mm, obovate, the apex rounded, white, widest at apex, turning reddish with age, densely covered with light golden stellate trichomes outside, glabrous inside with evident venation; staminal column 50 mm long, 2 mm in diam., white, glabrous, with a tuft of dense golden erect simple trichomes at the apex; stamens c. 70, filaments 20 mm, white, anthers 1.5 × 2 mm; styles 5, 25 mm, white, slender, delicate, covered with white erect simple and fasciculate trichomes, stigma c. 1.7 mm, bulbous. *Fruit* unknown.

Vernacular name. – "Hafatra-rora" (*Birkinshaw 2040*).

Distribution and ecology. – *Hibiscus vohipahensis* has the most southern distribution of all species discussed here and is known from two protected patches of lowland moist evergreen forests near Vangaindrano from 10 to 135 m elevation.

Conservation status. – *Hibiscus vohipahensis* is known from 6 locations from two protected areas (Agnakatrika and Ankarabolava). Despite the very restricted extent of occurrence (EOO) and area of occupancy (AOO) of c. 9 km^2, there appear to be no current threats to *H. vohipahensis*. Thus, the species is assigned a status of "Least Concern" [LC] IUCN Red List Categories and Criteria (IUCN, 2012), with the caution that this status is highly dependent on continued effective protection.

Notes. – *Hibiscus vohipahensis* differs from *H. analalavensis* in having longer petioles, 6–10 mm (vs. 4–5 mm), longer pedicels, 45 mm (vs. 30–32 mm), and wider petals, 12–18 mm (vs. 6–9 mm) that are pure white (vs. white to pink blush) that are widest at the apex (vs. widest in the middle of the petal). The staminal column in *H. vohipahensis* is also longer than that in *H. analalavensis*, 50 mm (vs. 30 mm) with filaments about twice as long, 20 mm (vs. 10 mm).

Paratypi. – Madagascar. **Reg. Atsimo-Atsinanana [Prov. Fianarantsoa]:** Vangaindrano, Vohipaho, forêt d'Ankarabolava, 23°31'51"S 47°29'48"E, 72 m, 17.IX.2009, fl., *Andriamihajarivo 1679* (MO, P, TAN, TEF); *ibid. loco*, 23°31'32"S 47°30'12"E, 13 m, 29.V.2014, bud, fl., *Birkinshaw 2040* (MO, P, TAN); Marofototra, NAP Ankarabolava-Agnakatrika, 23°30'24"S 47°30'51"E, 65 m, 5.VII.2010, fl., *Randrianarivony 164* (MO, P, TAN); c. 5 km au SE du village Sahavia, 23°26'21"S 47°30'34"E, 135 m, 19.X.2010, fl., *Razafitsalama 1409* (MO, P, TAN); forêt de Vohipaho, 23°26'34"S 47°30'50"E, 80 m, 22.IX.2009, bud, *Razanatsima 780* (MO, P, TAN).

Acknowledgments

The curators at the herbaria of G, MO, P, TAN and TEF are gratefully acknowledged for the opportunity to study specimens in their care. We are grateful to David Baum, Chris Birkinshaw, Lyn Craven, Pete Lowry, Brock Mashburn and Pete Phillipson for helpful discussion and tracking down specimens. Funding was provided by a Faculty Research Fellowship from Eastern Michigan University and the National Science Foundation (DDIG and grant DEB-1457589 to M. (Koopman) Hanes). We thank the following photographers for their field photographs to illustrate this article: Patrice Antilahimena, Chris Birkinshaw, Brock Mashburn, Fidy Ratovoson and David Scherberich. Finally, we thank two anonymous reviewers for their constructive comments that improved an earlier version of this manuscript.

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