

Taxonomic studies of *Diospyros* L. (Ebenaceae)
from the Malagasy region.
IV. Synoptic revision of the Squamosa group
in Madagascar and the Comoro Islands

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Taxonomic studies of *Diospyros* L. (Ebenaceae) from the Malagasy region.

IV. Synoptic revision of the *Squamosa* group in Madagascar and the Comoro Islands

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ABSTRACT

A synoptic revision of the *Squamosa* group of *Diospyros* L. (Ebenaceae) in Madagascar and the Comoro Islands is presented in which nine species are recognized, including six new species that are described and illustrated (*Diospyros antakaranae* Capuron ex G.E. Schatz & Lowry, sp. nov., *Diospyros betamponensis* G.E. Schatz & Lowry, sp. nov., *Diospyros callmanderi* G.E. Schatz & Lowry, sp. nov., *Diospyros darainensis* G.E. Schatz & Lowry, sp. nov., *Diospyros phillipsonii* G.E. Schatz & Lowry, sp. nov., and *Diospyros sennenii* G.E. Schatz & Lowry, sp. nov.). A key to the species is provided, along with an IUCN risk of extinction assessment for each species. Five species are assessed as Endangered (*D. betamponensis* G.E. Schatz & Lowry, sp. nov., *D. callmanderi* G.E. Schatz & Lowry, sp. nov., *D. darainensis* G.E. Schatz & Lowry, sp. nov., *D. phillipsonii* G.E. Schatz & Lowry, sp. nov., and *D. tetracerus* H. Perrier), one as Vulnerable (*D. antakaranae* Capuron ex G.E. Schatz & Lowry, sp. nov.), one as Near Threatened (*D. comorensis* Hiern), and two as Least Concern (*D. sennenii* G.E. Schatz & Lowry, sp. nov. and *D. squamosa* Bojer ex A. DC.).

RÉSUMÉ

Études taxonomiques de *Diospyros* L. (Ebenaceae) de la région malgache. IV. Révision synoptique du groupe *Squamosa* à Madagascar et aux Comores.

Une révision synoptique du groupe *Squamosa* du genre *Diospyros* L. (Ebenaceae) à Madagascar et aux Comores est présentée. Neuf espèces sont reconnues dont six nouvelles décrites et illustrées ici (*Diospyros antakaranae* Capuron ex G.E. Schatz & Lowry, sp. nov., *Diospyros betamponensis* G.E. Schatz & Lowry, sp. nov., *Diospyros callmanderi* G.E. Schatz & Lowry, sp. nov., *Diospyros darainensis* G.E. Schatz & Lowry, sp. nov., *Diospyros phillipsonii* G.E. Schatz & Lowry, sp. nov., et *Diospyros sennenii* G.E. Schatz & Lowry, sp. nov.). Une clé d'identification est fournie ainsi que des évaluations préliminaires du risque d'extinction selon les critères de la Liste Rouge de l'UICN. Cinq espèces sont considérées comme "En Danger" (*D. betamponensis* G.E. Schatz & Lowry, sp. nov., *D. callmanderi* G.E. Schatz & Lowry, sp. nov., *D. darainensis* G.E. Schatz & Lowry, sp. nov., *D. phillipsonii* G.E. Schatz & Lowry, sp. nov., et *D. tetracerus* H. Perrier), une "Vulnérable" (*D. antakaranae* Capuron ex G.E. Schatz & Lowry, sp. nov.), une "Quasi-menacée" (*D. comorensis* Hiern), et deux "Préoccupation mineure" (*D. sennenii* G.E. Schatz & Lowry, sp. nov. et *D. squamosa* Bojer ex A. DC.).

KEY WORDS

Ebenaceae,
Diospyros,
Madagascar,
Comoros,
Mayotte,
endemism,
conservation status,
lectotypification,
new synonyms,
new species.

MOTS CLÉS

Ebenaceae,
Diospyros,
Madagascar,
Comores,
Mayotte,
endémisme,
statut de conservation,
lectotypification,
synonymes nouveaux,
espèces nouvelles.

INTRODUCTION

An ongoing revision of the Ebenaceae of Madagascar, undertaken to update the *Flore de Madagascar et des Comores* treatment by Perrier de la Bâthie (Perrier de la Bâthie 1952), has revealed a large number of undescribed species in the genus *Diospyros* L. (Madagascar Catalogue 2020; Schatz & Lowry 2011, 2018; Schatz *et al.* 2013). Currently, of the *c.* 730 accepted species of *Diospyros* worldwide (Govaerts 2020), 91 species are recognized in Madagascar, of which all but three species are endemic, and an additional 155 endemic species have been tentatively identified as new to science (Madagascar Catalogue 2020). Most Malagasy *Diospyros* species can easily be placed in one of about a dozen informal morphological groups recognized on the basis of vegetative and reproductive features. Such groups constitute hypotheses of monophyletic groups within *Diospyros* as revealed by analyses using molecular sequence data (Duangjai *et al.* 2006, 2009; Linan *et al.* 2019). One such group, comprising *Diospyros squamosa* Bojer ex A. DC. and its putative relatives, has been named the Squamosa group. It is characterized by leaves with the midvein impressed adaxially; solitary, axillary, 4(-5)-merous female flowers that are surrounded in bud by distichous, overlapping, scale-like or squamose bracts; and oblong to spherical fruits surrounded at their base by an accrescent calyx whose lobes have margins that are usually strongly revolute.

Three currently recognized species conform to the Squamosa group (*D. comorensis* Hiern, *D. squamosa*, and *D. tetraceros* H. Perrier), to which an additional six new species are herein described, each accompanied by an illustration

and an assessment of its conservation status according to the IUCN Red List Categories and Criteria (2012) for which the area parameters of Extent of Occurrence (EOO) and Area of Occupancy (AOO) were calculated using GeoCat (2020). Basic information (locality, senior collector name and number) is provided for collections of the previously published taxa, whereas comprehensive collection data and a distribution map are given for the new species, with the exceptions of *D. antakaranae* Capuron ex G.E. Schatz & Lowry, sp. nov. and *D. sennenii* G.E. Schatz & Lowry, sp. nov., which can form large enough trees to be potentially exploited as a source of ebony, and for which geo-coordinates and detailed locality information have therefore been withheld. Specimen records are available for all members of the group in the *Catalogue of the Plants of Madagascar* (Madagascar Catalogue 2020) and the Sonnerat database (Sonnerat 2020). Post-facto georeferencing of historical specimens is indicated by square brackets.

TAXONOMIC TREATMENT

The Squamosa group comprises an informally recognized assemblage of nine species of *Diospyros*, six of which are new to science and are described below. The group is centered in Madagascar, although one species, *D. comorensis* Hiern, was based on material from Mayotte in the Comoro Islands, where it was collected more than 170 years ago but has not been recorded since.

KEY TO THE SPECIES OF THE SQUAMOSA GROUP OF *DIOSPYROS* L.

1. Leaves with persistent indument on the abaxial surface; Daraina, subhumid transitional forest 5. *D. darainensis* G.E. Schatz & Lowry, sp. nov.
- Leaves glabrous on the abaxial surface 2
2. Young stems with persistent, erect, golden trichomes to 3 mm long; central-east, humid forest 2. *D. betamponensis* G.E. Schatz & Lowry, sp. nov.
- Young stems glabrous or with scattered, sparse trichomes < 1 mm long 3
3. Leaves 17.7-27.7 × 6.4-10.4 cm; largest bracts subtending the flowers 10 × 17 mm; Kalabenono massif, subhumid forest 3. *D. callmanderi* G.E. Schatz & Lowry, sp. nov.
- Leaves not exceeding 14 × 5.8 cm; largest bracts subtending the flowers no more than 7 × 8 mm 4
4. Apex of leaves obtuse to rounded or broadly acute 5
- Apex of leaves acuminate (occasionally narrowly acute) 6
5. Leaves oblong, the length to width ratio 3-4:1; western Madagascar, along rivers in dry forest *D. phillipsonii* G.E. Schatz & Lowry, sp. nov.
- Leaves elliptic, the length to width ratio 2-3:1; Daraina, Ampondrabe, subhumid forest *D. sennenii* G.E. Schatz & Lowry, sp. nov.
6. Largest leaves at least 5 cm long 7
- Largest leaves not exceeding 5 cm long 8
7. Lobes of calyx in fruit strongly revolute with the margins involute; male flowers sessile, usually borne in triads; E coast and Sambirano, humid to subhumid forest *D. squamosa* Bojer ex A. DC.
- Lobes of calyx in fruit flat to slightly revolute, the margins flat; male flowers pedicellate, 3-7 borne in cymose inflorescences; Antsiranana area S to Nossi Be and Anjajavy and on Mayotte (Comoros Islands), dry to subhumid forest *D. comorensis* Hiern

8. Calyx lobes in fruit spreading, the apex recurved, forming 4 horn-like projections, their margins accrescent, revolute, the sinuses strongly accrescent and revolute, nearly concealing the exterior surface of the calyx cup; fruits *c.* 1.1 cm in diam.; Mahajanga and Ambato-Boeny, dry forest *D. tetraceros* H. Perrier
- Calyx lobes in fruit erect to slightly reflexed, not developing into horn-like projections, the calyx cup not concealed; fruits at least 1.7 cm in diam. 9
9. Leaves elliptic to narrowly elliptic, base cuneate to attenuate, not decurrent on the petiole; mature fruit with appressed golden trichomes *c.* 1 mm long; Montagne d'Ambre, Montagne des Français, dry forest *D. antakaranae* Capuron ex G.E. Schatz & Lowry, sp. nov.
- Leaves ovate to narrowly ovate, base acute to rounded, decurrent on the petiole; mature fruit glabrescent, often slightly glaucous; E coast and Sambirano, humid to subhumid forest *D. squamosa* Bojer ex A. DC.

CLÉ DES ESPÈCES DU GROUPE SQUAMOSA DE *DIOSPYROS* L.

1. Feuilles munies d'un indument persistant sur la surface abaxiale ; Daraina, forêts subhumides de transition ...
..... 5. *D. darainensis* G.E. Schatz & Lowry, sp. nov.
- Feuilles glabres sur la surface abaxiale 2
2. Jeunes rameaux munis de trichomes dorés érigés et persistants longs de 3 mm ; centre est, forêts humides
..... 2. *D. betamponensis* G.E. Schatz & Lowry, sp. nov.
- Jeunes rameaux glabres ou avec des trichomes épars longs de < 1 mm long 3
3. Feuilles mesurant 17,7-27,7 × 6,4-10,4 cm; bractées les plus grandes à la base des fleurs 10 × 17 mm ; massif de Kalabenono, forêts subhumides 3. *D. callmanderi* G.E. Schatz & Lowry, sp. nov.
- Feuilles ne dépassant pas 14 × 5,8 cm; bractées à la base des fleurs ne dépassant pas 7 × 8 mm 4
4. Apex des feuilles obtus à arrondi ou largement aigu 5
- Apex des feuilles acuminé (rarement étroitement aigu) 6
5. Limbes foliaires oblongs, leur rapport longueur-largeur de 3-4:1 ; bords de rivières en forêts sèches de l'ouest
..... *D. phillipsonii* G.E. Schatz & Lowry, sp. nov.
- Limbes foliaires elliptiques, leur rapport longueur-largeur de 2-3:1 ; Daraina, Ampondrabe, forêts subhumides
..... *D. sennenii* G.E. Schatz & Lowry, sp. nov.
6. Feuille la plus grande au moins 5 cm de longueur 7
- Feuille la plus grande ne dépassant pas 5 cm de longueur 8
7. Lobes du calice en fruit fortement révolutes, les marges fortement involutées ; fleurs mâles sessiles, généralement en groupes de 3 ; côte Est et Sambirano, forêts humide ou subhumide..... *D. squamosa* Bojer ex A. DC.
- Lobes du calice en fruit légèrement révolutes, les marges planes ; fleurs mâles pédicellées, en groupes de 3-7 formant des inflorescences cymeuses ; région d'Antsiranana jusqu'à Nossi Be et Anjajavy, ainsi que Mayotte (Iles Comores), forêt sèche à subhumide *D. comorensis* Hiern
8. Lobes du calice en fruit étalés, recourbés à l'apex, formant 4 projections ressemblant à des cornes, leurs marges accrescentes, révolutes, les sinus fortement accrescents et révolutes, cachant presque entièrement la surface extérieure de la coupe du calice ; fruits *c.* 1,1 cm de diamètre ; Mahajanga et Ambato-Boeny, forêts sèches
..... *D. tetraceros* H. Perrier
- Lobes du calice en fruit érigés à légèrement réfléchis, ne formant pas de projections, la coupe du calice visible ; fruits au moins 1,7 cm de diamètre 9
9. Limbes foliaires elliptiques à étroitement elliptiques, à base cunée à atténuée, non décurrente sur le pétiole ; fruits mûrs munis de trichomes dorés de *c.* 1 mm de long ; Montagne d'Ambre, Montagne des Français, forêts sèches *D. antakaranae* Capuron ex G.E. Schatz & Lowry, sp. nov.
- Limbes foliaires ovales à étroitement ovales, base aiguë à arrondie, décurrente sur le pétiole ; fruits mûrs glabrescents, souvent glauques ; côte Est et Sambirano, forêts humides à subhumides *D. squamosa* Bojer ex A. DC.

Diospyros antakaranae Capuron ex G.E. Schatz & Lowry, sp. nov. (Fig. 1)

Diospyros antakaranae Capuron ex G.E. Schatz & Lowry, sp. nov. is distinguished from *D. squamosa* Bojer ex A. DC. by its smaller, elliptic to narrowly elliptic leaves with a cuneate to attenuate base and mature fruit densely covered with appressed golden trichomes *c.* 1 mm long.

TYPUS. — **Madagascar**. Diana Region [Prov. Antsiranana], Montagne des Français, 25.II.2007, fr., *Razafitsalama* 1213 (holo-, MO[MO6438622]; iso-, CNARP, P[P00722633], TAN[TAN002012]!).

PARATYPES. — **Madagascar**. Diana Region [Prov. Antsiranana]: Ramena, Andavakoera, 20.II.2007, ster., *Guittou* 345 (CNARP, MO, P, TAN); Montagne d'Ambre, 29.XII.2011, late ♀ fl., *Nusbaumer et al.* 3284 (G, P[P01060531]); Antsapano, 11.VIII.2005, bud, *Rakotonasolo* &

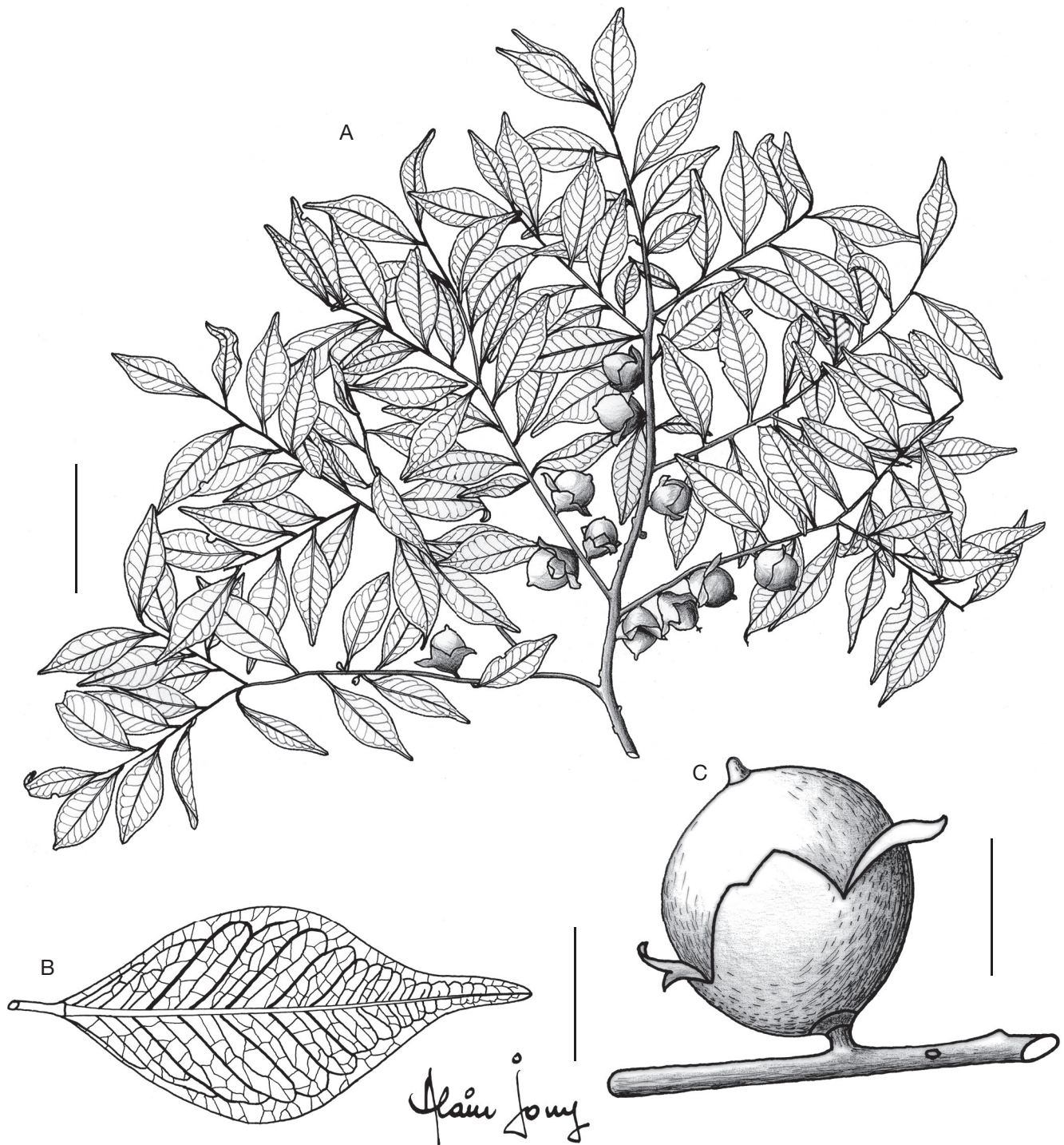


FIG. 1. — *Diospyros antakaranae* Capuron ex G.E. Schatz & Lowry, sp. nov.: **A**, fruiting branch; **B**, detail of leaf venation; **C**, fruit. A-C, *Service Forestier* 8331 (P03975401). Illustration by A. Jouy. Scale bars: A, 4 cm; B, C, 1 cm.

Rapanarivo 1036 (TAN, W); Montagne d'Ambre, 18.XII.2011, ♂ fl., *Ramandimbimanana* & *Randimbiarison* 181 (G, P[P01060546]); same locality, 20.XII.2011, ♂ fl., *Randimbiarison* & *Ramandimbimanana* 40 (G, P[P01060533]); Mahavanona, 25.I.2005, fr., *Randrianarivelo et al.* 163 (MO, P[P01031022], TAN); Montagne d'Ambre, 31.VIII.1952, ♀ fl., *Service Forestier* (*Randriamanatina*) 5795 (G, K, MO, P[P03974935, P03974936], TEF); Massif d'Ampitilantsambo, 19.II.1954, fr., *Service Forestier* 8331 (MO, P [P03975401], TEF); Massif de l'Ambongoabo, à l'ouest de Diégo-Suarez, 26.I.1966, fr., *Service Forestier* 24457 (G,

MO, P[P03975365, P03975366], TEF, W); Montagne des Français, 12.XI.1979, ster., *Service Forestier* 29601 (TEF); same locality and date, ster., *Service Forestier* 29602 (TEF).

ETYMOLOGY. — The name *Diospyros antakaranae*, sp. nov. was written by René Capuron on specimens at P and TEF, but was never published. He appears to have based this name on the Antakarana ethnic group of northern Madagascar, who live in the area inhabited by this new species.

DISTRIBUTION AND ECOLOGY. — *Diospyros antakaranae*, sp. nov. occurs in dry forest in the far north of Madagascar, extending from the northern parts of Montagne d'Ambre and nearby areas situated slightly farther north to Montagne des Français, from 116 to 900 m elevation.

PHENOLOGY. — *Diospyros antakaranae*, sp. nov. has been recorded in flower from August to December, and in fruit in January and February.

VERNACULAR NAME. — Mampingo (*Service Forestier* 5795).

CONSERVATION STATUS. — *Diospyros antakaranae*, sp. nov. has a geographic range in the form of an EOO of 421 km² and a minimum AOO of 32 km². It is present in the protected areas of Montagne d'Ambre and Montagne des Français. It is threatened by fire, grazing, and development outside of these protected areas, and likely also within them. With respect to the principal threat of fire, which will result in projected continuing decline in habitat quality, *D. antakaranae* Capuron ex G.E. Schatz & Lowry, sp. nov. exists at seven locations, and can therefore be assessed for its risk of extinction as Vulnerable [VU B1ab(iii)+2ab(iii)] (IUCN 2012).

DESCRIPTION

Shrub to tree 3-7 m tall, 6-40 cm DBH. Young stems whitish, slender, 1 mm in diam., sparsely covered with semi-erect gray trichomes to 2 mm long, glabrescent. Lamina 1.9-5.0 × 0.8-2.5 cm, narrowly elliptic to elliptic, coriaceous, glabrous above and below, base acute to cuneate to attenuate, rarely obtuse, margin micro-revolute and initially sparsely ciliate with grayish trichomes 0.7 mm long, apex acuminate, occasionally slightly falcate, the acuminate to 1.1 cm, the very tip rounded, midvein slightly impressed above, raised below, initially covered with sparse grayish trichomes 0.7 mm long below, venation weakly brochidodromous, 7-9 secondary veins per side, completely obscure above, slightly raised below; petiole 3-4 mm, < 1 mm in diam., terete to slightly flat adaxially, sparsely covered with semi-erect gray trichomes to 2 mm long, glabrescent. Male flowers solitary in axils of fallen leaves, enclosed within 5 distichous, overlapping, cucullate bracts, becoming progressively larger from base to apex of the pedicel, the largest broadly ovate to round, 3.5 × 4 mm, sparsely covered with minute appressed trichomes to glabrous, the margins minutely ciliate; pedicel 2-3 mm long, 0.5 mm in diam.; calyx urceolate, 3 mm tall, 5-6 mm in diam. at apex, with 5 triangular lobes, 0.5 × 1 mm, densely covered with semi-appressed golden trichomes 1-1.5 mm long; corolla white in vivo, tubular, fused portion 3 mm long, with 5 free, overlapping and spreading, depressed ovate lobes, 2 × 4 mm, the tube glabrous to densely covered with minute appressed trichomes at apex outside, the lobes densely covered with short (0.2 mm) appressed trichomes outside, sparsely covered with minute appressed trichomes inside; stamens *c.* 15-20, anthers sessile, 2.5-3 × 0.5 mm. Female flowers solitary in the axils of leaves, enclosed within 5-7 distichous, overlapping cucullate bracts, collectively broadly ovate, 2-3 × 2-4 mm, becoming progressively larger from base to apex, rounded to narrowly ovate, densely covered with short, matted appressed golden trichomes outside except glabrous towards the ciliate margins, glabrous inside; pedicel 1.4-5 mm long, 1.2-2 mm in diam., with a dense ring of trichomes at apex subtending

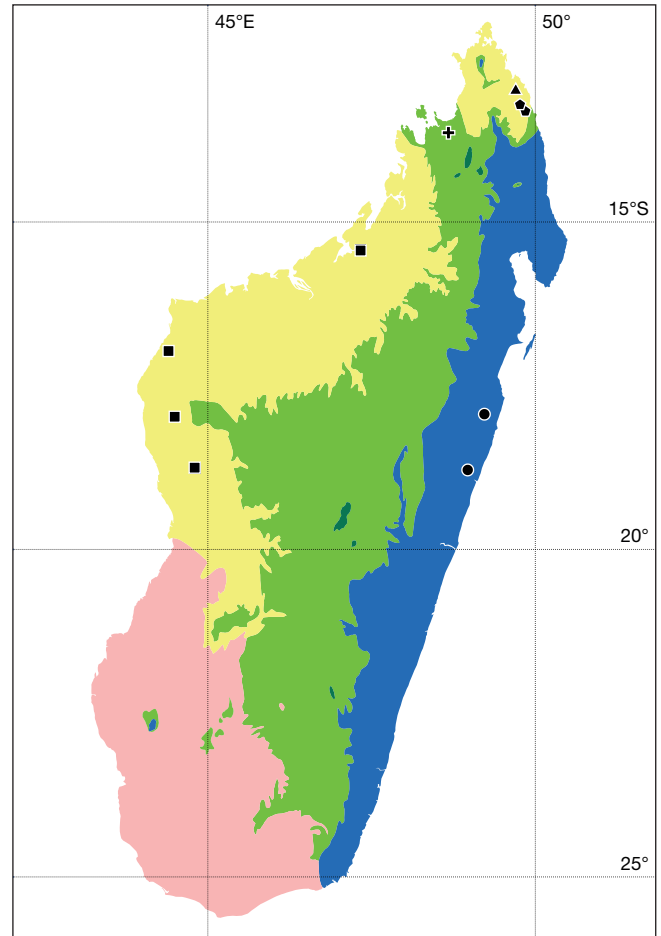


FIG. 2. — Geographic distribution of *Diospyros betamponensis* G.E. Schatz & Lowry, sp. nov. (●), *Diospyros callmaderi* G.E. Schatz & Lowry, sp. nov. (✕), *Diospyros darainensis* G.E. Schatz & Lowry, sp. nov. (●), *Diospyros phillipsonii* G.E. Schatz & Lowry, sp. nov. (●), and *Diospyros sennenii* G.E. Schatz & Lowry, sp. nov. (▲), mapped on the bioclimatic regions of Madagascar (after Cornet 1974; see Schatz 2000).

the receptacle; calyx urceolate, 4-merous, 4-5 mm tall, 7 mm in diam. at apex, the 4 lobes triangular, 5 × 5-6 mm, margins slightly revolute, densely covered with semi-appressed golden trichomes 1-1.5 mm long; corolla not seen; ovary ovoid, 4 mm tall, densely covered with appressed white trichomes, stigma with 4 bifid branches, 2 mm long. Fruit borne on an accrescent receptacle, to 5 mm long, 3-5-3.8 mm in diam., with a ring of downward appressed golden grayish trichomes around the base; fruit 17 mm tall, 17 mm in diam., slightly flattened globose, the stylar remnant 1.5-2 mm long, moderately to densely covered towards the apex with appressed golden trichomes *c.* 1 mm long, calyx in fruit covering *c.* one half of fruit, 8 mm tall, the lobes 10 × 12 mm, triangular, the apex reflexed, margins of the lobes slightly revolute, covered with dense, matted, appressed golden trichomes.

NOTES

This species can be recognized from other members of the *Squamosa* group by its relatively small, narrowly elliptic to elliptic leaves with a cuneate to attenuate base, and its mature

fruit covered with appressed golden trichomes *c.* 1 mm long. Because individuals of this species can become large trees and may therefore be targeted as a source of ebony wood, only general locality information has been provided for the cited collections.

Diospyros betamponensis G.E. Schatz & Lowry, sp. nov.
(Figs 3; 4)

Diospyros betamponensis G.E. Schatz & Lowry, sp. nov. is distinguished from other species in the *Squamosa* group by its slender young stems moderately to densely covered with long (2.5–3 mm), erect, golden trichomes as well minute erect white trichomes.

TYPUS. — **Madagascar.** Atsinanana Region [Prov. Toamasina], forêt orientale, Réserve naturelle no. 1 (Betampona, près d'Ambodiriana, District Tamatave), *c.* 450 m, 7.XI.1953, fr., *Service Forestier (Capuron)* 8593 (holo-, P[P04569888]!; iso-, K!, MO[MO6075826]!, P[P04569889]!, TEF).

PARATYPES. — **Madagascar.** Atsinanana Region [Prov. Toamasina]: Betampona RNI, 17°55'36"S, 49°12'29"E, 245 m, 18.I.2014, ster., *Bernard & Razakamalala* 2237 (MO, P[P00722708]!); Fokontany Fontsimavo, forêt d'Analamaimbo, 17°55'59"S, 49°13'19"E, 76 m, 9.II.2016, bud, y. fr., *Rasoanindriana et al.* 11 (K, MO, P, TAN); Betampona RNI, 28.IX.1993, bud, *Lewis & Razafimandimbison* 669 (MO, P[P04569897]!); Betampona Strict Nature Reserve, 17°55'33"S, 49°12'02"E, 400 m, 11.I.2017, fr., *Lowry et al.* 7483 (MO, P, TAN); Trail from Fontsimaro to Rendrirendry, S of Betampona Strict Nature Reserve, 17°55'57"S, 49°03'13"E, 65 m, 14.I.2017, ♀ fl., *Lowry et al.* 7510 (G, MO, P, TAN); Fokontany d'Analamangahazo, forêt d'Agnalavôla, 17°52'42"S, 49°15'04"E, 295 m, 13.III.2017, fr., *Ralaijaona et al.* 94 (K, MO, P, TAN); Betampona RNI, 9.XII.1950, fr., *Réserves Naturelles* 2222 (P[P04569891, P04569892], TAN); same locality, 8.X.1954, fl., *Réserves Naturelles* 6664 (P[P04569894], TEF); same locality, 9.XI.1957, fl., *Réserves Naturelles* 9152 (P[P04569893], TEF); same locality, 6.XII.1957, fl., *Réserves Naturelles* 9369 (P); same locality, 6.XII.1957, fr., *Réserves Naturelles* 9569 (P[P04569895]!); Sahafina forest W of Brickaville, 18°55'08.9"S, 49°12'03.9"E, 192 m, 9.I.2017, ster., *Schatz et al.* 4434 (MO, P, TAN).

ETYMOLOGY. — The name chosen for this new species reflects the fact that it is primarily known from the Betampona protected area.

DISTRIBUTION AND ECOLOGY. — *Diospyros betamponensis*, sp. nov. occurs in humid forest in the Atsinanana region, from the Sahafina forest W of Brickaville to the Betampona reserve and environs (Fig. 2), at elevations from 76 to 450 m.

PHENOLOGY. — *Diospyros betamponensis*, sp. nov. has been recorded in bud in September, in flower in October and November, and in fruit from November to January.

CONSERVATION STATUS. — *Diospyros betamponensis*, sp. nov. has a geographic range in the form of an EOO of 118 km² and a minimum AOO of 12 km². It is present in the protected areas of Betampona and Sahafina. Outside of these protected areas, it is threatened by forest clearing for agriculture and harvesting for firewood and construction material. With respect to the principal threat of forest clearing for agriculture, which will result in projected continuing decline in EOO, AOO, habitat quality, the number of locations, and the number of mature individuals, *D. betamponensis*, sp. nov. exists at four locations, and can therefore be assessed for its risk of extinction as Endangered [EN B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)] (IUCN 2012).

DESCRIPTION

Medium tree to 12 m tall, to 7 cm DBH. Young stems slender, 1 mm in diam., brown, moderately to densely covered with long (2.5–3 mm), erect, golden trichomes as well as minute erect white trichomes. Lamina 2.9–8.6 × 0.9–2.4 cm, narrowly ovate to occasionally oblong, coriaceous, glabrous and matte above, glabrous and glossy below, base rounded to truncate, margin flat to micro-revolute, apex acute to acuminate, midvein impressed and channeled above, densely covered with minute, erect, white trichomes, prominently raised below, moderately to densely covered with long (2.5–3 mm), semi-erect golden trichomes, venation weakly brochidodromous, 9–13 secondary veins per side, obscure above, raised below; petiole 3–4 mm, < 1 mm in diam., covered with both long (2.5–3 mm) erect, golden trichomes and minute, erect white trichomes. Male flowers not seen. Female flowers solitary in the axils of leaves; pedicels 2–3 mm (–4 mm in fr.), 2–3 mm in diam. (–5 mm in fr.), glabrous except for a ring of dense short golden trichomes at the apex, bearing 6–9 distichous, overlapping, cucullate scale-like bracts, 1–6 × 2–8 mm, broadly ovate, becoming progressively larger from the base to apex of the pedicel, mostly glabrous outside, occasionally with dense, minute, erect whitish trichomes toward the apex, glabrous inside, the margin densely golden ciliate, especially at the apex, often keeled, apex acute to shallowly to deeply emarginate on apical-most bract; sepals fused into an urceolate calyx, 7–8 mm tall, 5–6 mm in diam., with 4 or 5 lobes, 2–3 × 2 mm, apex triangular, densely covered with long golden semi-appressed trichomes and shorter curly, matted trichomes; petals glabrous. Fruit to 25 mm tall, 25 mm in diam., spherical to flattened-spherical or somewhat cubical, glabrous and sometimes glaucous, the styler remnant 2 mm tall, surrounded by the accrescent calyx, densely covered with long (to 3 mm) semi-appressed, golden trichomes, the lobes 8–17 × 10–22 mm, broadly to narrowly triangular, the margins flat or reflexed or involute, densely covered with curly, matted, woolly, appressed golden trichomes; seeds spherical wedge shaped, 16–18 × 6 mm.

NOTES

Diospyros betamponensis, sp. nov. is easily recognized among members of the *Squamosa* group by its slender young stems moderately to densely covered with long (2.5–3 mm), erect, golden trichomes.

Diospyros callmanderi G.E. Schatz & Lowry, sp. nov.
(Figs 5; 6)

Diospyros callmanderi G.E. Schatz & Lowry, sp. nov. is distinguished from *D. squamosa* Bojer ex A. DC. by its very large leaves (17.7–27.7 × 6.4–10.4 cm) and very large bracts enclosing the female flowers (to 10 × 17 mm).

TYPUS. — **Madagascar.** Diana Region [Prov. Antsiranana], Ambilobe, Beramanja, Anketrabe, forêt de Kalabenono, pente raide en bas de crête, sol profond, 13°38'13"S, 48°40'07"E, 244 m, 18.XI.2006, fr., *Callmander et al.* 519 (holo-, MO[MO6449179]!; iso-, G[G00443323]!; P[P02091758]!; TAN[TAN001880]!).



FIG. 3. — *Diospyros betamponensis* G.E. Schatz & Lowry, sp. nov.: **A**, fruiting branch; **B**, branch with flower buds; **C**, fruit; **D**, detail of leaf venation (abaxial surface). **A, C**, Réserves Naturelles 2222 (P04569891); **B, D**, Lewis & Razafimandimbison 669 (P04569897). Illustration by A. Jouy. Scale bars: A, B, 4 cm; C, D, 1 cm.

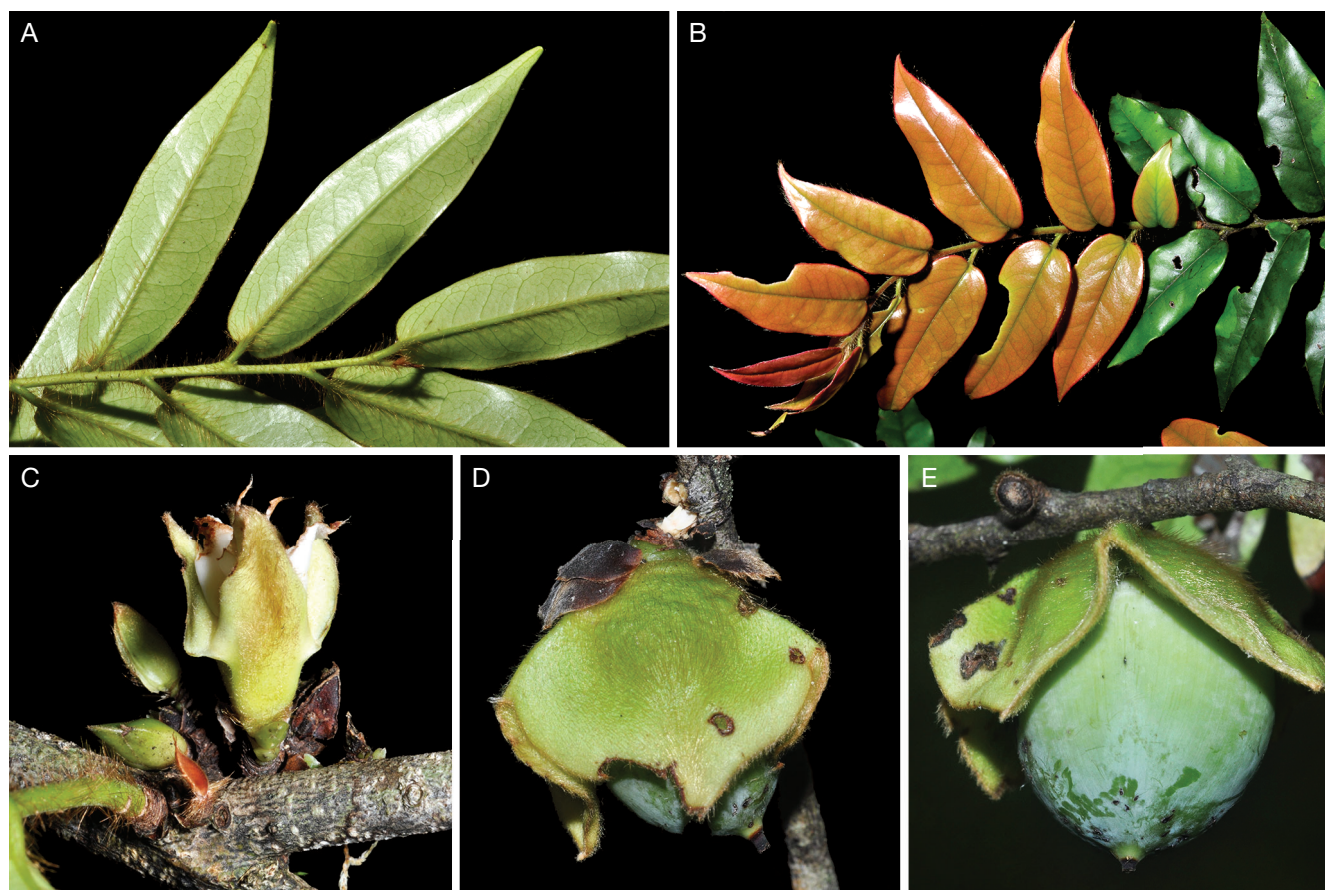


FIG. 4. — Photos of *Diospyros betamponensis* G.E. Schatz & Lowry, sp. nov.: **A**, branch showing indument on stem and leaves; **B**, branch with young leaves; **C**, female flower; **D**, young fruit with squamæ at base; **E**, fruit. **A, D, E**, Lowry et al. 7483; **B, C**, Lowry et al. 7510. Photos: A-E, P. Lowry.

PARATYPES. — **Madagascar.** Diana Region [Prov. Antsiranana]: Ambilobe, Beramanja, Anketrabe, village le plus proche Antanambao Belinta, versant NW du Kalabenono, source de rivière Androkaroka, 13°38'58"S, 48°40'27"E, 744 m, 26.XI.2007, bud, *Rakotovao et al.* 3809 (G[G00443324], MO, P[P00722709], TAN); Ambilobe, Beramanja, Anketrabe Belinta, forêt de Manongarivo-Kalabinono, 13°38'16"S, 48°40'21"E, 425 m, 29.IX.2013, fl., *Razakamalala et al.* 7570 (MO, P[P00580500], TAN).

ETYMOLOGY. — This species is named in honor of our good friend and colleague Martin W. Callmander, who worked for the Missouri Botanical Garden's Madagascar Program from 2005 to 2015 before taking a position at the *Conservatoire et Jardin botaniques de la Ville de Genève*, and who has contributed so much to our knowledge of the Malagasy flora through his research on Pandanaceae and the multi-year field program he coordinated focusing on the Northern Mountains Complex, among many other endeavors.

DISTRIBUTION AND ECOLOGY. — *Diospyros callmanderi*, sp. nov. occurs in subhumid forest in the Diana region, wholly within the Galoko-Kalobinono protected area (Fig. 2), from 244 to 744 m elevation.

PHENOLOGY. — *Diospyros callmanderi*, sp. nov. has been recorded in flower or bud in September and November, and in fruit in November.

CONSERVATION STATUS. — *Diospyros callmanderi*, sp. nov. has a geographic range in the form of an EOO of 0.265 km² and a minimum AOO of 0.265 km². All three collections were made within the protected area of Galoko-Kalobinono. However, two of them, which are situated within 400 m of each other, are less than 200 m

from cleared pasture land, whereas the third collection is over a kilometer away within dense forest. Therefore, with respect to the threat of projected additional forest clearing, which will result in continuing decline in EOO, AOO, habitat quality, the number of locations, and the number of mature individuals, *D. callmanderi*, sp. nov. exists at two locations, and can therefore be assessed for its risk of extinction as Endangered [EN B1ab(i,ii,iii,iv,v)+2ab(i,i,iii,iv,v)] (IUCN 2012).

DESCRIPTION

Shrub to tree 4-7 m tall, to 7 cm DBH. Young stems initially covered with very sparse scattered appressed short trichomes, glabrescent. Lamina 17.7-27.7 × 6.4-10.4 cm, ovate to oblong, coriaceous, glabrous above and below, base obtuse to rounded, margin revolute, apex acute to rounded, midvein deeply impressed and channeled above, prominently raised below, venation weakly brochidodromous, secondary veins 11-15 per side, with occasional intersecondaries nearly as prominent, flat to slightly raised above and below; petiole 11-20 mm, terete to slightly flat topped, 3-4 mm diam., glabrous, drying black. Male flowers not seen. Female flowers solitary in the axils of leaves; pedicels 4-6 mm long, 3-5 mm in diam., bearing 8-12 distichous, overlapping, scale-like bracts, 3-10 × 5-17 mm, enclosing the flower in bud, broadly obovate, becoming progressively larger from the base to the apex of the pedicel, apex emarginate, glabrous both outside

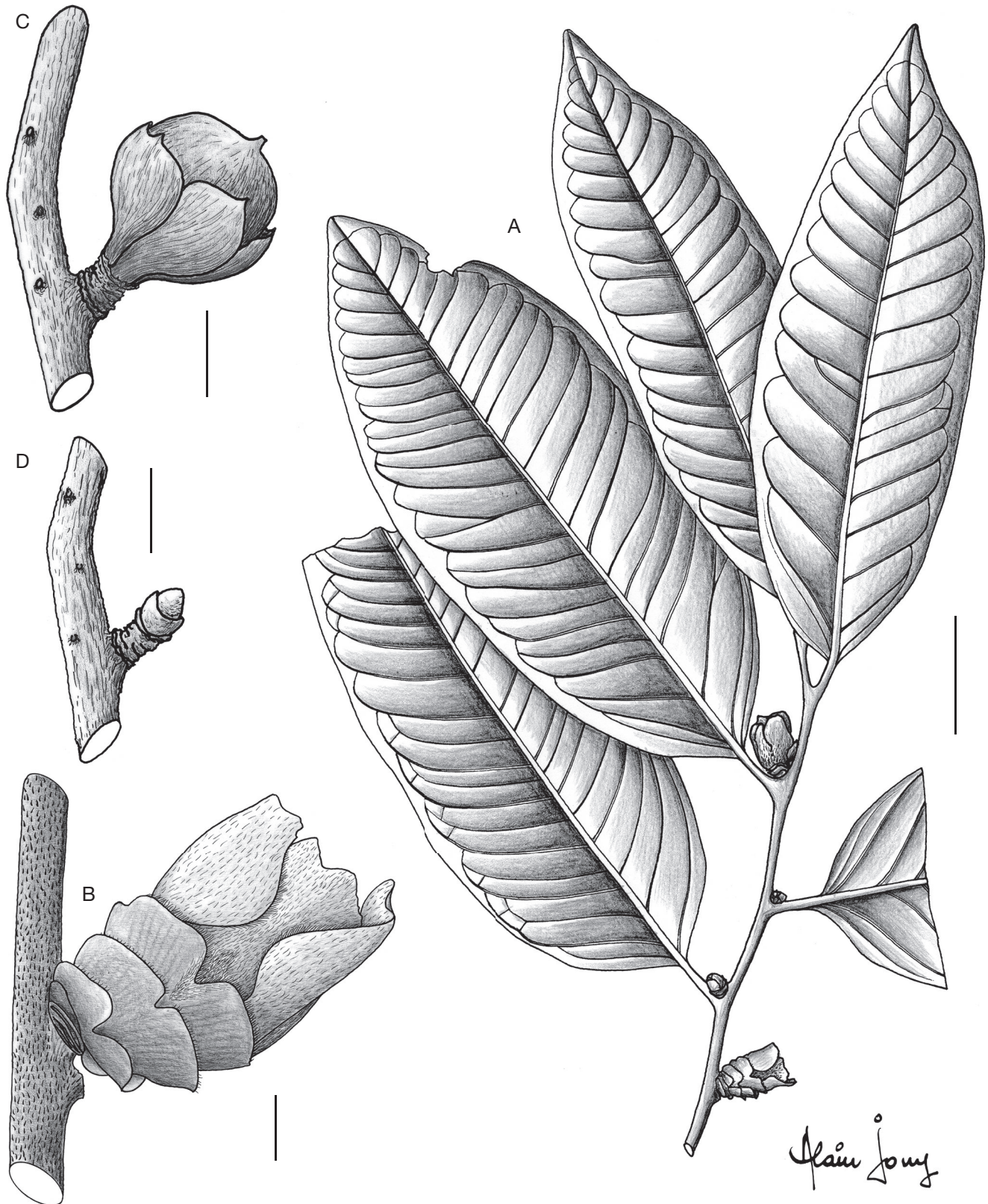


FIG. 5. — *Diospyros callmanderi* G.E. Schatz & Lowry, sp. nov.: **A**, branch with female flowers; **B**, female flower bud with squamulae at base; **C**, fruit; **D**, persistent fruiting pedicel. **A**, **B**, Razakamalala et al. 7570 (P00580500); **C**, **D**, Callmander et al. 519 (P02091758). Illustration by A. Jouy. Scale bars: A, 4 cm; B, 5 mm; C, D, 1 cm.

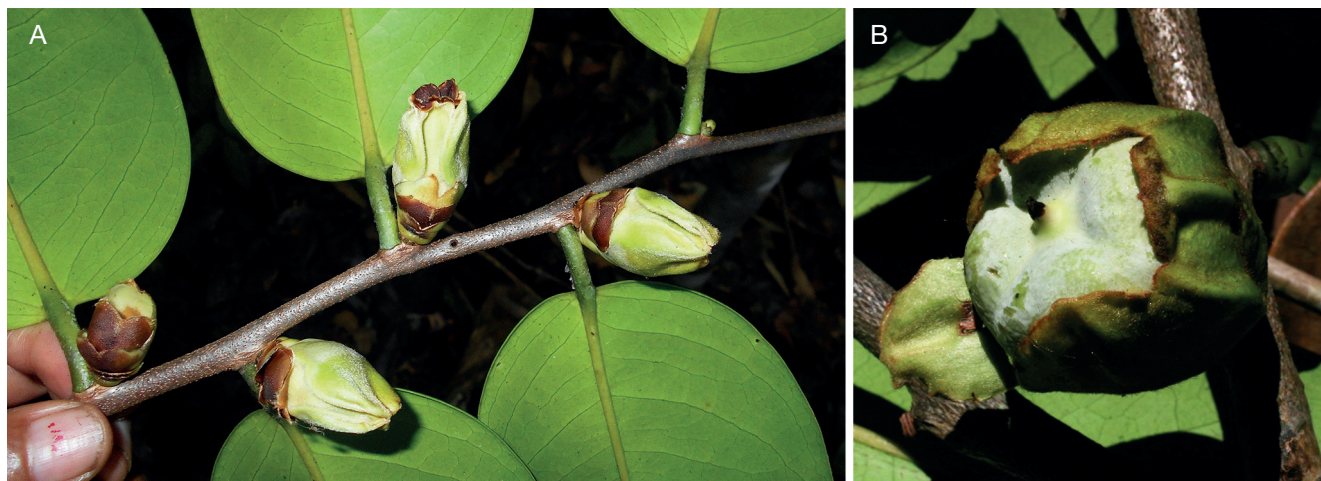


FIG. 6. — Photos of *Diospyros callmanderi* G.E. Schatz & Lowry, sp. nov.: **A**, branch with female flowers and buds; **B**, fruit. **A**, Callmander et al. 519; **B**, Razakamalala et al. 7570. Photos: A, M. Callmander; B, R. Razakamalala.

and inside except densely covered with golden appressed trichomes at the exposed apex, the margins ciliate, the pedicel densely covered with erect golden trichomes at the base of the bracts and crowned by a ring of erect trichomes at the apex; sepals 4, fused into a short tubular calyx, 20 mm long, the free lobes arranged in two decussate pairs, 12×14 mm, apex acute, densely covered with appressed golden trichomes. Pedicel in fruit crowned by the bulbous, rounded accrescent receptacle, 4.5 mm tall, with bract scars clearly evident. Fruit 27–32 mm tall, 27 mm in diam., globose to slightly cubical, the apex flat, with the stylar remnant 2–3 mm tall, glabrous and somewhat glaucous, the calyx persistent and accrescent, $22\text{--}26 \times 18\text{--}22$ mm, densely covered with appressed trichomes, distinctly 4-ridged, the ridges formed from the margins of the two outer sepals.

NOTES

Diospyros callmanderi, sp. nov. is easily recognized among members of the Squamosa group by its very large leaves ($17.7\text{--}27.7 \times 6.4\text{--}10.4$ cm) and very large bracts enclosing the female flowers (to 10×17 mm). Indeed, when we first saw specimens of *D. callmanderi*, sp. nov., we immediately referred to it as “*D. squamosa* on steroids”.

Diospyros comorensis Hiern (Fig. 7)

Transactions of the Cambridge Philosophical Society 12: 220 (1873). — Lectotype (here designated): Mayotte, without precise locality, 1846–1848, Boivin s.n. (W[W0007071]!).

Diospyros ankifiensis H. Perrier, *Mémoires de l'Institut scientifique de Madagascar, série B, Biologie végétale* 4: 153 (1952). — Lectotype (designated by Schatz & Lowry 2011): Madagascar. Diana Region [Prov. Antsiranana], Ambohipiraka, $[13^{\circ}10'30''\text{S}, 49^{\circ}06'00''\text{E}]$, X.1932, Perrier de la Bâthie 18751 (lecto-, P[P00541730]!; isolecto-, P[P00541731]!), syn. nov.

ADDITIONAL MATERIAL EXAMINED. — Madagascar. Diana Region [Prov. Antsiranana]: Analabe, *Andriamihajarivo* 1370; Ankarana AP, *Andrianantoanina* 726, 968; same locality, *Bardot-Vaucoulon* 843, 1341, 1577; Montagne des Français, *Be* 326; Nossi Be, *Boivin s.n.*; Andavakoera, *Guittou* 354; Ankarana AP, *Harder* 1707; Sommet de la forêt de Galoko, *Manjato* 493; Bobataolana, *Rakotoarisoa* 474; Ambondromifehy, *Rakotoarisoa* 622; Ananjaka, forêt de Tsiandrotonana, *Randrianaivo* 1107; Ankarana AP, *Randrianaivo* 2405, 2427; Anjahana, *Randrianaivo* 3299; Montagne des Français, *Ratovoson* 1270; Ampombiantambo, *Razafitsalama* 1228, 1249; Ankarana, *Rogers* 1158; Antsampano, Beately, *Rakotonasolo* 1040; Ankarana AP, *Randrianaivo* 3234, 3235, 3236, 3237, 3238; Sahafary, *Schatz* 4360; Ankarana AP, *Service Forestier* 6190, 7271, 10430, 10661, 18975. — Sofia Region [Prov. Mahajanga]: Anjajavy, *Rasoafaranaivo* 245, 254.

DISTRIBUTION AND ECOLOGY. — *Diospyros comorensis* occurs in dry to subhumid forest in northwestern Madagascar from Anjajavy to Montagne des Français, and on Mayotte in the Comoro Islands (Madagascar Catalogue 2020).

PHENOLOGY. — *Diospyros comorensis* has been recorded in flower in March and April, and in fruit from July to February.

VERNACULAR NAMES. — Jobiampototra (*Andrianantoanina* 968; *Service Forestier* 6190, 10430, 10661), Mampingo (*Rasoafaranaivo* 254).

CONSERVATION STATUS. — *Diospyros comorensis* has a geographic range in the form of an EOO of 72,225 km² and a minimum AOO of 84 km². It has been recorded in the protected areas of Ankarana, Galoko-Kalobinono, and Montagne des Français (and possibly Lokobe). Outside of these protected areas it is threatened by fire, clearing of forest for agriculture, and collection of firewood and construction material. With respect to the principal threats of fire and forest clearing for agriculture, *D. comorensis* exists at 15 locations, and can therefore be assessed for its risk of extinction as Near Threatened [NT], as it nearly qualifies for Vulnerable status under criterion B2 (IUCN 2012).

NOTES

Diospyros comorensis can be distinguished from *D. squamosa* by its male flowers borne on pedicels in branched cymose inflorescences (vs. sessile in triads) and by its fruiting calyx, which is flat to slightly revolute with the margins flat (vs. strongly revolute,



FIG. 7. — Photos of *Diospyros comorensis* Hiern: **A**, branch with young fruits; **B**, young fruit; **C**, branch with fruits; **D**, fruits; **E**, fruits seen from above. **A, B**, Schatz 4360; **C**, Randrianaivo 1107; **D**, Manjato 493; **E**, Razafitsalama 12490. Photos: A-B, G. Schatz; C, R. Randrianaivo; D, M. Randriatsivery; E, J. Razafitsalama.

the margins revolute). It has not been recollected from the type locality on Mayotte in the Comoro Islands since 1846-1848. Hiern (1873) based his description of *D. comorensis* on *Boivin s.n.* from Mayotte in the Comoro Islands, for which the only known specimen, deposited at W [W0007071], bears an annotation with his handwriting indicating that he considered this entity to be a new species. Comprehensive examination of all material of *Diospyros* at P failed to reveal any additional material belonging to this gathering. While the sheet at W could be regarded as the holotype, we have chosen to designate it as the lectotype of *D. comorensis* since there may be a misplaced sheet at P.

Diospyros ankifiensis is here placed into synonymy under *D. comorensis*. Both of the original syntypes of *D. ankifiensis* (*Boivin s.n.* from Nossi Be and *Perrier de la Bâthie* 18751 from Ambohipiraka) conform vegetatively to the type of *D. comorensis*, while *Boivin s.n.* also exhibits identical male cymose inflorescences.

Diospyros darainensis G.E. Schatz & Lowry, sp. nov.
(Fig. 8)

Diospyros darainensis G.E. Schatz & Lowry, sp. nov. is distinguished from other members of the *Squamosa* group by the dense appressed

trichomes 0.1-0.2 mm long on both surfaces of its leaf blades (vs glabrous on the abaxial surface in all other taxa).

TYPUS. — **Madagascar.** Sava Region [Prov. Antsiranana]: Ouest (Nord): Versant Est du massif de l'Ankerana (partie S. du massif de Mafokovo), au N. de Vohémar, [13°18'S, 49°51'E], 50-450 m, 12.III.1967, fr., *Service Forestier (Capuron)* 27425 (holo-, P [P03975352]!; iso-, MO!, P[P02291779]!, TEF[TEF000888]!).

PARATYPES. — **Madagascar.** Sava Region [Prov. Antsiranana]: near Daraina on road to Vohemar, 13°12'S, 49°46' E, 200 m, 18.XII.1989, fr., *McPherson* 14699 (G, MO, P[P04539971]).

ETYMOLOGY. — The name chosen for this new species reflects the fact that it occurs in the Daraina region of northeastern Madagascar.

DISTRIBUTION AND ECOLOGY. — *Diospyros darainensis*, sp. nov. occurs in subhumid transitional forest between Daraina and Vohemar (Fig. 2), from 50-450 m elevation.

PHENOLOGY. — *Diospyros darainensis*, sp. nov. has been recorded in fruit in December and March.

CONSERVATION STATUS. — *Diospyros darainensis*, sp. nov. is known from only two collections, and thus has a geographic range in the form of an AOO of 8 km². One of the collections was made within the Loky Manambato protected area. At the other site, *D. darainensis*, sp. nov. is threatened by fire, forest clearing for agriculture, and collection of firewood and construction material. Therefore, with respect to the principal threat of forest clearing, *D. darainensis*, sp. nov. ex-



FIG. 8. — *Diospyros darainensis* G.E. Schatz & Lowry, sp. nov.: **A**, fruiting branch; **B**, fruit; **C**, detail of leaf venation. **A-C**, Service Forestier 27425 (P03975352). Illustration by A. Jouy. Scale bars: A, 4 cm; B, 1 cm; C, 5 mm.

ists at two locations. With projected continuing decline in AOO, habitat quality, the number of locations, and the number of mature individuals, *D. darainensis*, sp. nov. can therefore be assessed for its risk of extinction as Endangered [EN B2ab(ii,iii,iv,v)] (IUCN 2012).

DESCRIPTION

Tree 8–12 m tall. Young stems densely covered with very short (<0.1 mm), appressed and erect gray trichomes. Lamina 2.7–5.1 × 0.9–2 cm, oblong to occasionally slightly narrowly ovate or elliptic, coriaceous, glossy and verruculose above, densely covered with short appressed gray trichomes 0.1–0.2 mm long above, densely covered with short appressed light golden trichomes 0.1–0.2 mm below, base rounded to obtuse, margin revolute, apex rounded, midrib slightly impressed above, covered with dense, appressed gray trichomes, raised below, covered with dense, appressed golden trichomes, venation very weakly brochidodromous, with 7–9 secondary veins per side, faintly visible and only slightly raised above, flat below; petiole 2 mm, 1 mm in diam., densely covered with very short erect and appressed gray, slightly flattened above. Male flowers not seen. Female flowers not seen. Young fruit solitary in the axils of leaves. Pedicel in fruit 4 mm long, 2 mm in diam. at base to 4 mm in diam. at apex, with bract scars at the base, densely covered with semi-erect golden trichomes 0.3 mm long; calyx cupuliform in fruit, the fused portion 4–5 mm tall, with 4 slight ridges extending from the sinus to the base, calyx lobes 9 × 12–14 mm, broadly triangular, flat, but often the lobes irregularly folded in pressed material, the apex acute to obtuse, densely covered with very short golden, semi-appressed, curly trichomes both outside and inside; fruit (perhaps not full size?) 8 mm tall, 7 mm in diam., ovoid, glabrous, glaucous.

NOTES

Diospyros darainensis, sp. nov. can be easily recognized among other members of the Squamosa group by the dense appressed trichomes 0.1–0.2 mm long on both surfaces of its leaf blades.

Diospyros phillipsonii G.E. Schatz & Lowry, sp. nov. (Fig. 9)

Diospyros phillipsonii G.E. Schatz & Lowry, sp. nov. is distinguished from other species in the Squamosa group by its oblong leaves with a length:width ratio of 3–4:1 and a usually rounded apex.

TYPUS. — **Madagascar.** Melaky Region [Prov. Mahajanga], Réserve naturelle de Bemaraha, SE of Antsalova, 18°45'S, 44°48'E, 400 m, 23.VIII.1987, fr., *Phillipson* 2238 (holo-, MO[MO3514688]!; iso-, K!, P[P04539530]!, TAN[TAN001834]!).

PARATYPES. — **Madagascar.** Melaky Region [Prov. Mahajanga]: Beanka, partie centrale, Andranatsiritsy, forêt galerie, dans le cours d'eau, 17°58'23"S, 44°29'43"E, 206 m, 12.XII.2011, fr., *Nusbaumer et al.* 3090 (G, MO, P[P00872431], TEF); Rives boisées de l'Anapondy, affluent de droite de la Sofia, [15°26'S, 47°20'E], VIII.1905, ♀ fl., *Perrier de la Bâthie* 8774 (P[P00541700, P00541701]); Rocailles près des torrents, bassin moyen du Bemarivo (Boina), sur gneiss, [16°58'12"S, 44°24'00"E], 600 m, IX.1907, ♀ fl., *Perrier de la Bâthie* 8784 (P[P00541702, P00541703, P00541704]); Bemaraha RNI, 28.II.1960, fr., *Réserves Naturelles* 11132 (P[P04539531]).

ETYMOLOGY. — This species is named in honor of our good friend and colleague Peter B. Phillipson, with whom we have had the pleasure of collaborating since 1987, when he first started working in Madagascar at the Beza Mahafaly Reserve. Pete joined the staff of the Missouri Botanical Garden in 2003, and has contributed in numerous ways to our growing knowledge of the Malagasy flora, including through his field work, especially in the drier parts of the island, as well as taxonomic studies of dozens of groups, and has played a key role in the development of the on-line *Catalogue of the Plants of Madagascar*.

DISTRIBUTION AND ECOLOGY. — *Diospyros phillipsonii*, sp. nov. is distributed along rivers in dry forest in western Madagascar from Bemaraha to the Sofia River basin (Fig. 2), from 206 to 600 m elevation.

PHENOLOGY. — *Diospyros phillipsonii*, sp. nov. has been recorded in flower in August and September, and in fruit in August and December.

VERNACULAR NAME. — Lepingo (*RN 11132*).

CONSERVATION STATUS. — *Diospyros phillipsonii*, sp. nov. has a geographic range in the form of an EOO of 36 124 km² and a minimum area of occupancy of 16 km². It is present in the protected areas of Beanka, Bemaraha, and Bemarivo. Outside of these protected areas it is threatened by fire, forest clearing for agriculture, and collection of firewood and construction material. With respect to the principal threat of forest clearing for agriculture, *D. phillipsonii*, sp. nov. exists at four locations. With projected continuing decline in habitat quality, *D. phillipsonii*, sp. nov. can therefore be assessed for its risk of extinction as Endangered [EN B2ab(iiii)] (IUCN 2012).

DESCRIPTION

Shrub to tree 4–15 m tall. Young stems densely covered with very short (0.1–0.2 mm), erect gray trichomes or glabrous. Lamina 4.2–10.3 × 1.1–3.8 cm, oblong, the first leaves of a shoot 4.0–4.5 × 2.4 cm, ovate, coriaceous, with scattered very short erect gray trichomes above or glabrous, base rounded to obtuse, margin slightly revolute, apex rounded to rarely acute and then the acumen rounded, midrib slightly sunken above, covered with dense, matted, appressed gray trichomes or glabrous, raised below, venation weakly brochidodromous, with 11–13 secondary veins per side, faintly visible and only slightly raised above and below; petiole 3–5 mm, densely covered with short erect gray trichomes or glabrous, terete to slightly flattened above. Male flowers not seen. Female flowers in axillary, 1–3-flowered inflorescences from axils of fallen leaves, enclosed within 11–15, distichous, overlapping, cucullate bracts, collectively broadly ovate, 8 × 12 mm, the largest bract 6 × 6 mm, triangular to rounded, densely covered with semi-appressed, golden trichomes 0.5–0.8 mm long both inside and outside; peduncle 2–4 mm, 2–3 mm in diam.; flowers sessile; calyx urceolate to globose, 10–12 mm tall, 10–12 mm in diam., with 4 broadly triangular lobes, 4 × 9 mm, densely covered with semi-appressed, golden trichomes, less densely so just below the rim of calyx; corolla 10 mm tall, fused for basal 2–3 mm, the 4 lobes broadly triangular, 7 × 5 mm, base of the lobes auriculate, apex obtuse, glabrous, minutely verruculose outside; staminodia 4, 4 mm long, attached at the base of the corolla, filament 2 mm, antherode 2 mm; ovary globose, 3.5 mm, 3.5 mm in diam., verruculose, style 2.5–3 mm long, 1.5 mm in diam.;

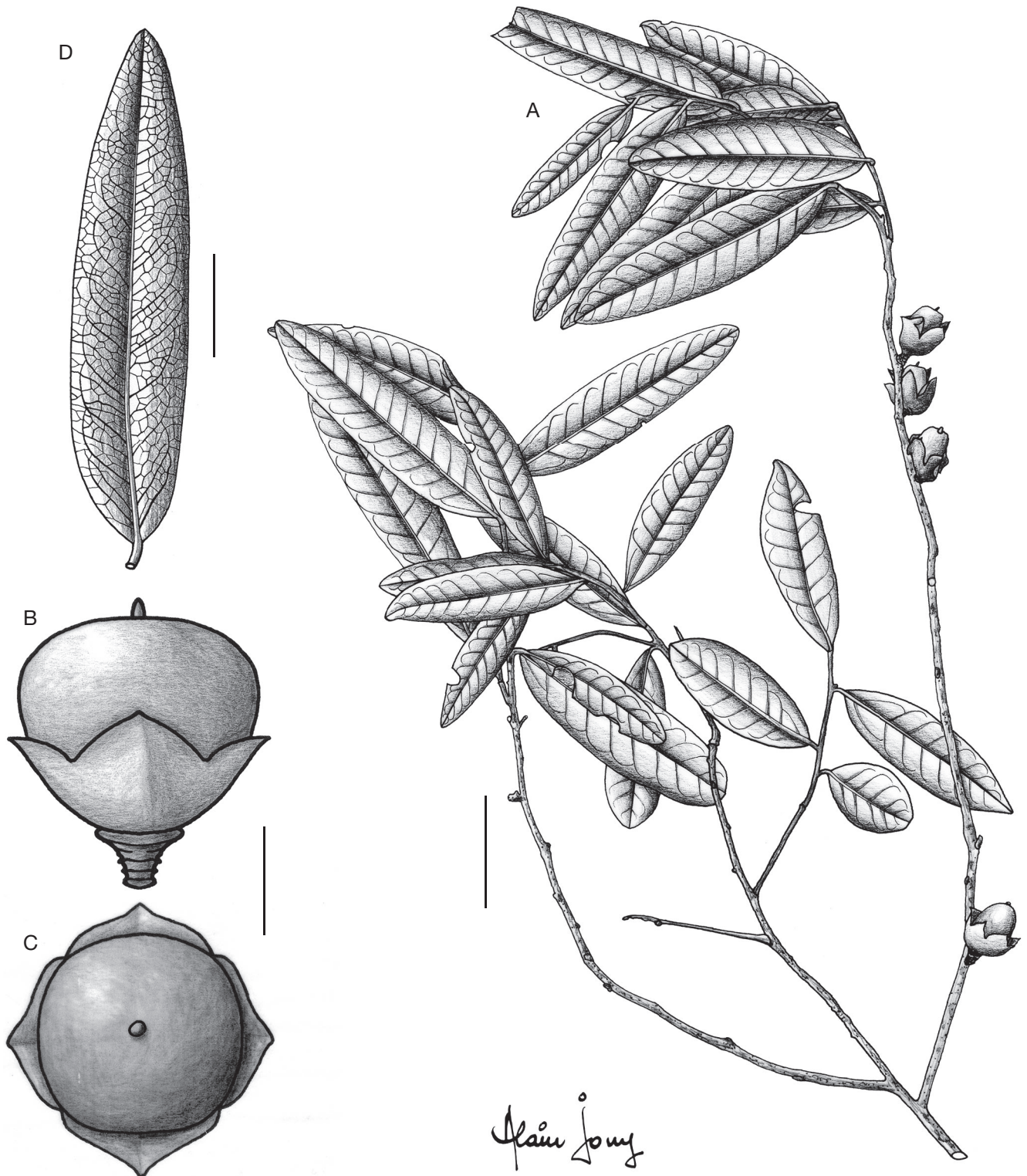


FIG. 9. — *Diospyros phillipsonii* G.E. Schatz & Lowry, sp. nov.: **A**, fruiting branch; **B**, fruit from side (note bract scars on pedicel); **C**, fruit from top; **D**, detail of leaf venation (adaxial surface). **A-D**, Nusbaumer et al. 3090 (P00872431). Illustration by A. Jouy. Scale bars: A, 4 cm; B, C, 12 mm; D, 2 cm.

stigma 4-lobed, the lobes narrowly triangular, 1×0.6 mm. Pedicel in fruit 3-4 mm $\times$ 2.5-3 mm; calyx in young fruit densely covered with very short golden, semi-appressed trichomes, in mature fruit the calyx lobes 7×12 -15 mm,

the apex and margins reflexed, the apex rounded to obtuse, the fused portion of the calyx 10-12 mm tall, the surface with 4 ridges extending from each sinus to the base; fruit 20-25 mm tall, 20 mm in diam., glaucous.

NOTES

Diospyros phillipsonii, sp. nov. can be recognized from other members of the Squamosa group by its oblong leaves with a length:width ratio of 3-4:1 and a usually rounded apex, the latter feature shared with *D. sennenii*, sp. nov. which, however, has elliptic lamina with a length:width ratio of 2-3:1. As here circumscribed, *D. phillipsonii*, sp. nov. includes two of the original syntypes of *D. cinnamomoides* H. Perrier (*Perrier de la Bâthie* 8774 and 8784), which were excluded at the time that species was lectotypified (Schatz & Lowry 2011).

Diospyros sennenii G.E. Schatz & Lowry, sp. nov.
(Fig. 10)

Diospyros sennenii G.E. Schatz & Lowry, sp. nov. is distinguished from other species in the Squamosa group by its elliptic to narrowly ovate lamina with a length:width ratio of 2-3:1 and a rounded to rarely obtuse apex.

TYPE. — **Madagascar.** Sava Region [Prov. Antsiranana], Vohemar, Daraina, Ambarilao, Tsaratanana, Ampondrabe, à l'ouest d'Ambarilao, 12°57'48"S, 49°41'57"E, 427 m, 24.IX.2007, fr., *S. Randrianasolo et al.* 612 (holo-, MO[MO6214778]!; iso-, CNARP, P[P06664490]!, TAN, TEF).

ETYMOLOGY. — This species is named in honor of Sennen Randrianasolo, a retired field botanist who worked at the *Centre National d'Application de Recherche Pharmaceutique* (CNARP) in Antananarivo, and who participated in an intensive collecting program conducted in collaboration with the Missouri Botanical Garden, first for the U.S. National Cancer Institute and then for an International Cooperative Biodiversity Groups project funded by the U.S. National Institutes of Health. Sennen made more than 1000 high quality collections from many parts of Madagascar, helping to build the CNARP herbarium while contributing to our expanding understanding of the island's flora.

DISTRIBUTION AND ECOLOGY. — *Diospyros sennenii*, sp. nov. occurs in subhumid forest to the NW of Ambarilao within the Loky Manambato protected area (Fig. 2), at an elevation of 427 m.

PHENOLOGY. — *Diospyros sennenii*, sp. nov. has been recorded in fruit in September.

CONSERVATION STATUS. — *Diospyros sennenii*, sp. nov. is known only from the type collection made within the Loky Manambato protected area NW of Ambarilao and 1 km inside the forest edge. It can thus be assumed that this species is currently not subject to any threats. Dependent upon continuing effective protection of the forest, *D. sennenii*, sp. nov. can therefore be assessed as Least Concern [LC] (IUCN 2012).

DESCRIPTION

Tree 10 m tall, 40 cm DBH. Young stems initially moderately densely covered with appressed white trichomes *c.* 0.1 mm long, glabrescent, the older stems whitish. Lamina 1.4-5 × 1-2.5 cm, elliptic to oblong to occasionally narrowly ovate, coriaceous, glabrous above and below, base rounded to truncate, margin flat, apex rounded to rarely obtuse, midrib very slightly impressed above, glabrous, slightly raised below and initially sparsely covered with appressed, white or golden trichomes < 0.1 mm long, glabrescent, venation

weakly brochidodromous, with 6-7 secondary veins per side, faintly visible, very slightly raised above and below; petiole 2-3 mm, *c.* 1 mm diam., initially moderately to densely covered with appressed white or golden trichomes *c.* 0.1 mm long, glabrescent, terete to slightly flattened above. Male flowers not seen. Female flowers not seen. Fruit solitary in the axils of fallen leaves; pedicel in fruit 5-6 × 4 mm, with evident scars from fallen bracts, moderately to densely covered with appressed golden and white trichomes *c.* 0.1 mm long; calyx in fruit urceolate, not keeled, densely covered with appressed white and golden trichomes *c.* 0.5 mm long, the fused portion of the calyx 20 mm tall, the lobes 10 × 20 mm, the margins flat, the apex acute, slightly reflexed; fruit 30-35 mm tall, 30 mm in diam., ellipsoid to spherical, shiny, slightly depressed at the apex, crowned by the style/stigma remnant.

NOTES

Diospyros sennenii, sp. nov. can be recognized within the Squamosa group by its elliptic to narrowly ovate lamina with a rounded to rarely obtuse apex. Because individuals of this species can become large trees and may therefore be targeted as a source of ebony wood, only general locality information has been provided for the cited collection.

Diospyros squamosa Bojer ex A. DC.
(Fig. 11)

Prodromus 8: 232 (1844). — Lectotype (here designated): **Madagascar.** Analanjirofo Region [Prov. Toamasina], in sylvis Madagascar prope Foule-Pointe, bud, *Bojer s.n.* (lecto-, G[G00142024]!; isolecto-, G[G00142114]!, K[K000350812]!, M[M-015315, M-015316] scans seen, P[P00573616]!, TUB[TUB-003374] scan seen).

Diospyros bernieri Hiern, *Transactions of the Cambridge Philosophical Society* 12: 268 (1873). — Type: **Madagascar.** Atsinanana Region [Prov. Toamasina], forêt de Tintingue, fr., *Bernier* 113 (holo-, P[P00541721]!; iso-, P[P00541722, P00541723]!), **syn. nov.**

Diospyros conifera H. Perrier, *Mémoires de l'Institut scientifique de Madagascar, série B, Biologie végétale* 4: 115 (1952). — Type: **Madagascar.** Diana Region [Prov. Antsiranana], forêt du Lokobe, Nossi-bé, VII.1850, ♂ bud, *Boivin* 2108/2B (holo-, P[P00541699]!), **syn. nov.**

ADDITIONAL MATERIAL EXAMINED. — **Madagascar.** Analanjirofo Region [Prov. Toamasina]: Tampolo, *Andrianjafy* 218; Hiaraka, *Antilahimena* 1309; Soanafindra, *Antilahimena* 1833; Ambitsy, *Antilahimena* 5729; Masoala AP, *Bernard* 1697; Tampolo, *Bernard* 2255; Mananara AP, *Birkinshaw* 362; Tampolo STF, *Dorr* 3385; Amboabe, *Lam* 5687; Andranobe, *McPherson* 17555, 17627; Tampolo, *Rabevohitra* 3909; Antanambao Ambodimanga, *Rakotonirina* 560; Manompana, *Rakotozafy* 1381bis; Tampolo STF, *Randrianasolo* 469; Andranotsara, *Razakamalala* 7713; Nosy Mangabe, *Schatz* 2043, 2130, 2139, 2193, 2224, 2228, 2517; Ambanizana, *Schatz* 3126; Farankaraina, *Service Forestier* 12980; Maimbosokina, *Service Forestier* 15757; Tampolo STF, *Service Forestier* 18169; Soanierana Ivongo, *Service Forestier* 18192, 18193; Farankaraina STF, *Service Forestier* 18321, 18348. — Anosy Region [Prov. Toliara]: Sainte Luce, *Gereau* 3312; Ampasimena, *Humbert* 20578; Sainte Luce, *Ludovic* 1758; Andohahela AP, *Malcomber* 1164; Sainte Luce, *McPherson* 14861; Ivohibe, *Rabenantoandro*



FIG. 10. — *Diospyros sennenii* G.E. Schatz & Lowry, sp. nov.: **A**, fruiting branch; **B**, detail of leaf venation (abaxial surface). **A**, **B**, S. Randrianasolo et al. 612 (P06664490). Illustration by A. Jouy. Scale bars: A, 4 cm; B, 1 cm.

1876; Marokoky, *Rabevohitra* 1920; Mandena, *Rabevohitra* 2070; Lakandava, *Rabevohitra* 3724; Mandena, *Rabevohitra* 3752; Sainte Luce, *Ramananjana* 626; Mandena, *Ramison* 93; Ambavarano, *Ramison* 122; Sainte Luce, *Ramison* 565; Andohahela AP, *Ran-*

driamampionona 469, 473; Ivohibe, *Randrianarivony* 641; Bevoay, *Randriatsivory* 696; Emagnobo, Malamamay, *Randrianasolo et al.* 1687; Mandena, *Razafimandimbison* 199; Ampasina, *Razakamalala* 4182; Bevoay, *Razakamala* 4702; Enato, *Razakamalala*

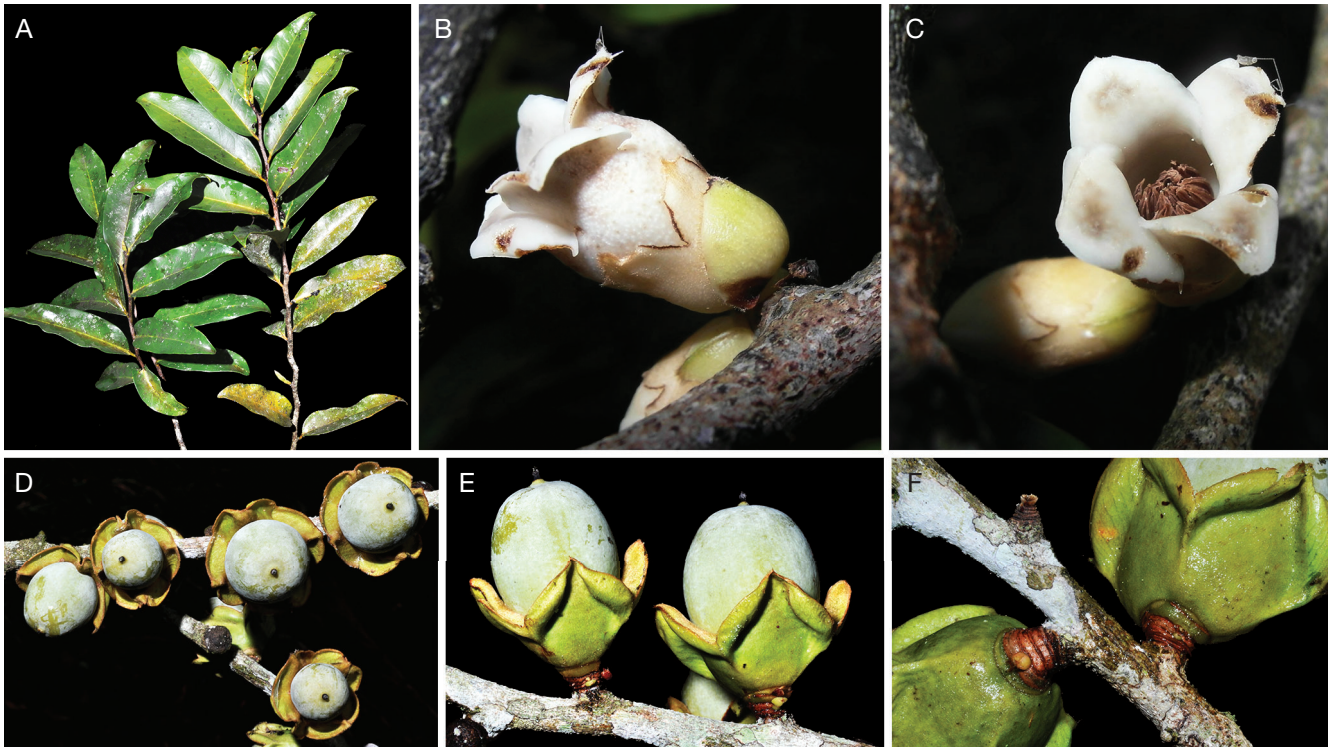


FIG. 11. — Photos of *Diospyros squamosa* Bojer ex A. DC.: **A**, leaves; **B**, male flower from side; **C**, male flower from top; **D**, fruiting branch; **E**, fruits; **F**, base of fruits (note bract scars on pedicels). **A**, **D**-**F**, Lowry 7534; **C**, **D**, Rasoanindriana 308. Photos: **A**, **D**-**F**, P. Lowry, **B**-**C**, P. Antilahimena.

5045; Sainte Luce, Razakamalala 7781; Bevoay, Razanatsima 1440, 1441, 1445, 1446; Andohahela AP, Réserves Naturelles 6640; Col de Lidro, Réserves Naturelles 7447; Andohahela AP, Réserves Naturelles 10056; Maningotry, Service Forestier 4147; Imonty, Service Forestier 13941; Mandena, Service Forestier 28632; Mandena, Zarucchi 7444. — Atsimo-Atsinanana Region [Prov. Fianarantsoa]: Rienana, Decary 5793; Manombo AP, McPherson 18438; Manombo AP, Ankararano, Perrier 12629; Service Forestier 12932; Amporofo, Service Forestier 13917; Belambo, Service Forestier 15259; Vatovavy-Fitovinany, Mananjary, Geay 8016, 8017, 8018; Andromba, Service Forestier 10102; Andafa, Service Forestier 14570. — Atsinanana Region [Prov. Toamasina]: Analalava, Bernard 2261; Tintingue, Bernier 113; Foulepointe, Bojer s.n.; Mahatsara STF, Ludovic 177; Antaimby, Ludovic 584; Vohibe, Rakotoarivelo 631; Ambalavontaka, Ranaivojaona 606, 607, 736, 747; Ambalabe, Randrianaivo 1870; Antaimby, Razakamalala 1555, 1563; Antetezana STF, Service Forestier 2980; Andranokoditra, Service Forestier 32440. — Diana Region [Prov. Antsiranana]: Ampasindava, Rasoanaivo 37; Betsitsika, Ammann 258, 270, 340; Tsarabanja, Bernard 1221; Bandrakorony, Bernard 1324, 1406; Bongomihiravavy, Nusbaumer 2566, 2871; Betsitsika, Nusbaumer 2956; Nosy Be, Lokobe RNI, Antilahimena 148, Birkinshaw 148, Boivin 2108/2b; Manongarivo RS, Gautier & Derleth 2543; Betsitsika, Gautier 5298; Sorata, Razakamalala 3817; Betsitsika, Tahinarivony 251; Ampasindava, Tahinarivony 702. — Sava Region: Masoala AP, Bernard 321; Andrahanjo, Bernard 1612; Masoala AP, Bernard 1664, 1667; Ambalavy, Bernard 1711, 1737; Ambinany, Bernard 1771; Tsihomanaomby, Birkinshaw 2013; Marojejy AP, Cours 3225; Ambalavoniho, Humbert 22793; Antongondriha, Humbert 23984; Andravinaambo, forêt d'Antsaolatra, Martial 420; Masoala AP, Rahajasoa 438, 606; Andravinaambo, forêt d'Antsaolatra, Rakotonirina 51; Ambarizara, Ranarivelo 1231; Marojejy AP, Ravelonarivo 3412, 3413; Bezavona, Ravelonarivo 3576; Masoala R.N.I. 2, Réserves Naturelles 5717; Marojejy AP, Réserves Naturelles 11959.

DISTRIBUTION AND ECOLOGY. — *Diospyros squamosa* is widely distributed in humid to subhumid forest, from Fort Dauphin to N of Sambava and in the NW from the Ampasindava peninsula to Nossi Be (Madagascar Catalogue 2020). It occurs from sea level to 1400 m elevation.

PHENOLOGY. — Flowering material has been collected in all months except May, July, November and January; fruiting has been recorded throughout the year.

VERNACULAR NAMES. — Hazojoby (*Rasoanaivo* 37, *Tahinarivony* 702), Hazomafana (*Service Forestier* 2980, 12980), Hazomainty (*Service Forestier* 4147, 10102, 12932, 13941), Korofoka (*Ramison* 122), Maintipototra (*Cours* 3225; *Réserves Naturelles* 5717, 11959), Maintiampototra (*Rakotonirina* 51), Torofoky (*Réserves Naturelles* 100056).

CONSERVATION STATUS. — *Diospyros squamosa* has a geographic range in the form of an EOO of 230 164 km² and a minimum AOO of 376 km². It is present in numerous protected areas (Ampasindava, Analalava, Andohahela, Lokobe, Makira, Mandena, Manombo, Marojejy, Masoala, Nosy Mangabe, Sainte Luce, Tampolo, and Vohibe), and exists at over 60 locations with respect to the principal threat of forest clearing for agriculture. *Diospyros squamosa* can therefore be assessed for its risk of extinction as Least Concern [LC] (IUCN 2012).

NOTES

Diospyros squamosa can be recognized from other members of the Squamosa group by its glabrous twigs, ovate to narrowly ovate leaves with the base decurrent along the petiole, sessile male flowers borne in triads, strongly revolute fruiting calyx, and glabrescent fruit that is often glaucous. In the southeastern portion of its range, *D. squamosa* often exhibits much smaller leaves. *Diospyros bernieri* and *D. conifera* are here placed in synonymy under *D. squamosa*; the type of the former (Bernier 113) from “forêt de Tintingue” along

the East coast exhibits leaves and fruit identical to *D. squamosa*, whereas the type of the latter (*Boivin 2108/2B*) from Lokobe on Nosy Be also exhibits leaves identical to those of *D. squamosa* as well as the characteristic bracts surrounding the sessile male flowers.

Diospyros tetraceros H. Perrier

Mémoires de l'Institut scientifique de Madagascar, série B, Biologie végétale 4: 151 (1952). — Lectotype (designated by Schatz & Lowry 2011): **Madagascar**. Boeny Region [Prov. Mahajanga], ravin rocaillieux d'Antsahabe aux environs d'Amboanio, [15°49'S, 46°21'E], VI.1908, fr., *Perrier de la Bâthie 8799* (lecto-, P[P00573652]!; isolecto-, P[P00573651, P00573653]!).

ADDITIONAL MATERIAL EXAMINED. — **Madagascar**. Boeny Region [Prov. Mahajanga]: cousse d'Ankara, *Perrier de la Bâthie 1160*.

DISTRIBUTION AND ECOLOGY. — *Diospyros tetraceros* occurs in dry riverine forest in northwestern Madagascar in the Ambato-Boeny Region in the basin of the Betsiboka river (Madagascar Catalogue 2020).

PHENOLOGY. — *Diospyros tetraceros* has been recorded in flower in January, and in fruit in June.

CONSERVATION STATUS. — *Diospyros tetraceros* has a geographic range in the form of an AOO of 8 km². It is not known from any protected areas, and is threatened by fire, forest clearing for agriculture, and collection of firewood and construction materials. With respect to the principal threats of fire and forest clearing for agriculture, *D. tetraceros* exists at two locations, and can therefore be assessed as Endangered [EN B2ab(iii)] (IUCN 2012).

NOTES

Diospyros tetraceros has not been collected since 1908. It can be distinguished from other members of the *Squamosa* group by its small leaves and calyx lobes forming 4 horn-like projections and sinuses strongly revolute, nearly concealing the exterior surface of the calyx cup.

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