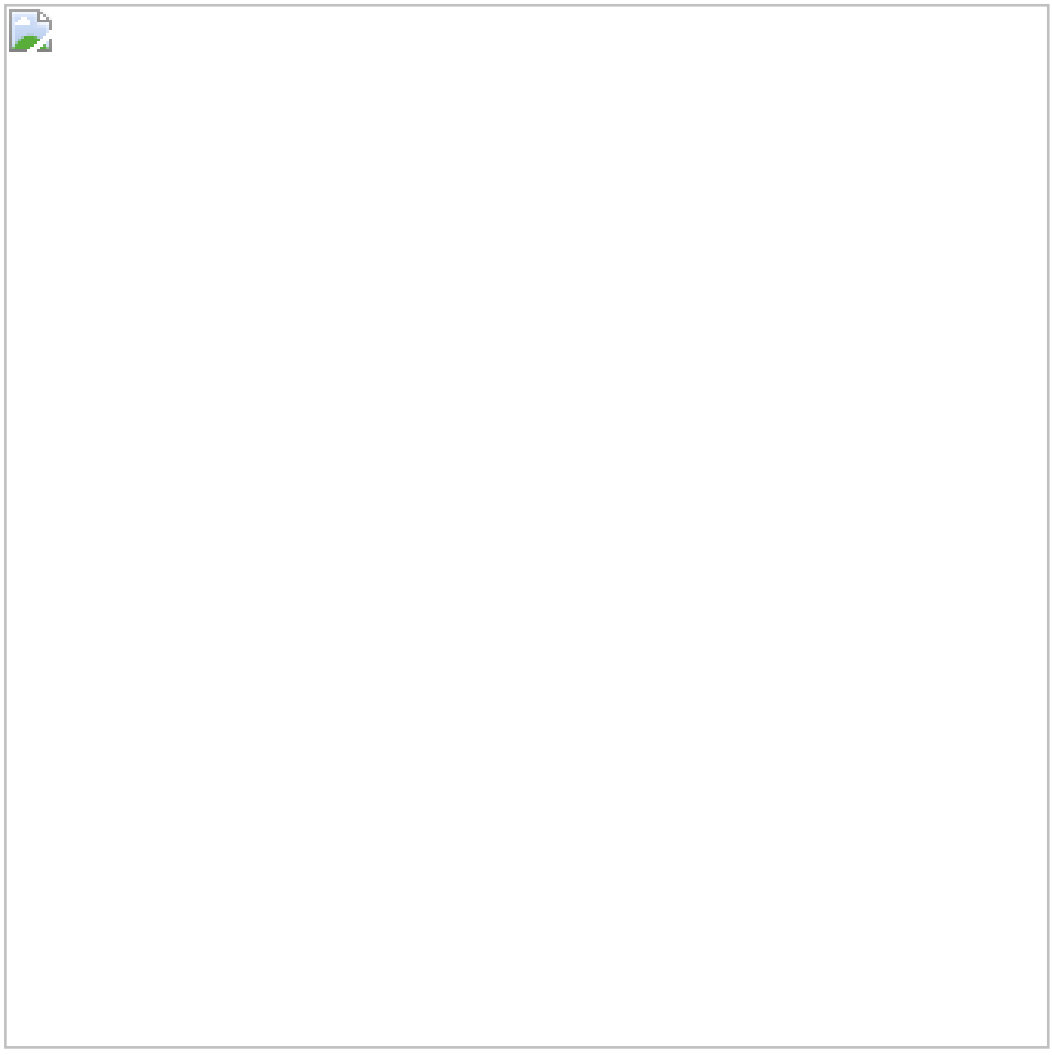

Taxonomic studies of Diospyros (Ebenaceae) from the Malagasy region. X. Revision of the Tetraclis group

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Taxonomic studies of Diospyros (Ebenaceae) from the Malagasy region. X. Revision of the Tetraclis group

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Abstract

LINAN, A.G., H.N. RAKOUTH, M. RABARIMANARIVO, G.E. SCHATZ & P.P. LOWRY II (2024). Taxonomic studies of Diospyros (Ebenaceae) from the Malagasy region. X. Revision of the Tetraclis group. *Candollea* 79: 129–169. In English, English and French abstracts. DOI: http://dx.doi.org/10.15553/c2024v791a8

A revision of the Tetraclis group of *Diospyros* L. (*Ebenaceae*) in Madagascar is presented in which 22 taxa are recognized, including 19 species (of which six are newly described) and three subspecies (two new to science). This group is characterized by valvate corolla aestivation (vs. imbricate and appearing twisted in other groups), distinctive cymose to pseudo-umbellate male inflorescences bearing fauve to rusty indumentum and flowers with numerous stamens (c. 20–80 vs. 8–30), and often apically mucronate leaves. A description is provided for each taxon along with color photographs, and each novelty is illustrated with a line drawing. An identification key to the species is also provided (in English and French) along with risk of extinction assessments for each taxon based on the IUCN Red List Criteria, which indicate that one species is "Critically Endangered" [CR], eight are "Endangered" [EN], and one is "Vulnerable" [VU], while six are "Near Threatened" [NT] and three are "Least Concern" [LC]. A lectotype is designated for the name *D. urschii* H. Perrier.

Résumé

LINAN, A.G., H.N. RAKOUTH, M. RABARIMANARIVO, G.E. SCHATZ & P.P. LOWRY II (2024). Études taxonomiques du genre Diospyros (Ebenaceae) de la région malgache. X. Révision du groupe Tetraclis. *Candollea* 79: 129–169. En anglais, résumés en anglais et français. DOI: http://dx.doi.org/10.15553/c2024v791a8

Une révision du groupe Tetraclis du genre *Diospyros* L. (*Ebenaceae*) à Madagascar est présentée dans laquelle 22 taxons sont reconnus, comprenant 19 espèces (dont six nouvellement décrites) et trois sous-espèces (dont deux nouvelles). Ce groupe est caractérisé par des corolles à préfloraison valvées (alors qu'elles sont imbriquées et semblent tordues dans d'autres groupes), des inflorescences mâles distinctives en cymoses à pseudo-ombellées portant un indumentum fauve à rouille et des fleurs avec de nombreuses étamines (c. 20–80 contre 8–30) et des feuilles souvent mucronées apicalement. Chaque taxon fait l'objet d'une description accompagnée de photographies en couleurs et chaque nouveauté est également illustrée par un dessin au trait. Une clé d'identification des espèces est fournie (en anglais et en français), ainsi que des évaluations du risque d'extinction pour chaque taxon sur la base des critères de la Liste Rouge de l'UICN. Ils indiquent qu'une espèce est «En danger critique» [CR], huit «En danger» [EN] et une «Vulnérable» [VU], tandis que six sont «Quasi menacée» [NT] et trois «Préoccupation mineure» [LC]. Un lectotype est désigné pour le nom *D. urschii* H. Perrier.

Keywords

EBENACEAE – *Diospyros* – *Tetraclis* – Madagascar – New species – Typification

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Introduction

The most recent comprehensive revision of *Ebenaceae* in Madagascar, published more than 70 years ago by Perrier de la Bâthie (1952a, b), recognized a total of 97 species and 15 infraspecific taxa in three genera, *Diospyros* L. (76 spp.), *Maba* J.R. Forst. & G. Forst. (18 spp.), and *Tetraclis* Hiern (3 spp.). An ongoing revision of the Malagasy members of the family, which are now all placed in *Diospyros* (Schatz & Lowry, 2011; Madagascar Catalogue, 2024), has reduced the number of previously published species that are now accepted to 89 and has also revealed many new, undescribed species, 56 of which have been published to date (Schatz & Lowry, 2018, 2020; Schatz et al., 2020, 2021a, b; Linan et al., 2021). This has brought the total number of described species to 145 (Madagascar Catalogue, 2024), which, along with the estimated 140 additional new species that remain to be described, results in a total of about 285 species, all but two of which are endemic to the island, making *Diospyros* the most speciose genus of woody plants on Madagascar.

The majority of Malagasy *Diospyros* can be assigned to one of about 18 informal groups, each of which comprises species that exhibit broad morphological similarities in their reproductive and vegetative structures, suggesting that they may be monophyletic. Molecular data have provided tentative support for many of these groups (Linan et al., 2019; Linan, unpubl. data), including one that contains two of the three species previously placed in the genus *Tetraclis* by Perrier de la Bâthie (1952a, b) that are now recognized as *Diospyros baronii* (Hiern) H.N. Rakouth & Lowry and *D. clusiifolia* (Hiern) G.E. Schatz & Lowry [the third species, *D. ebenifera* (H. Perrier) G.E. Schatz & Lowry does not belong to the Tetraclis group]. *Tetraclis*, as originally recognized by Hiern (1873) and later by Perrier de la Bâthie (1952a, b), was characterized by valvate corolla aestivation (vs. imbricate and appearing twisted in other genera) and male flowers with a large number of stamens (c. 20–80 vs. 8–30 in other genera).

Today, based on careful examination of the more than 7,500 collections of *Diospyros* now available from Madagascar (over an order of magnitude greater than what Perrier was able to study), a total of 13 currently recognized species are considered to belong to the Tetraclis group, along with six new species and two new subspecies. Members of the group, as currently delimited, are further characterized by their distinctive cymose to pseudo-umbellate male inflorescences bearing fauve to rusty indumentum, and the leaves of many species have a mucronate apex. Here we present a detailed revision of the Tetraclis group and provide full descriptions for each of the new taxa as well as slightly abbreviated ones for the previously described species. Each new species is accompanied by a line illustration, and color photos of the fruits are provided for all taxa. In addition, we have prepared updated risk of extinction assessments based on the IUCN Red List Categories and Criteria (IUCN, 2012) for previously described species as well as preliminary assessments for the new species and subspecies.

Of the 22 taxa treated in this revision, 14 are considered to form large trees, reaching or exceeding 20 m in height and/or 20 cm in diameter at breast height (DBH), considered to be potential sources of commercially exploitable ebony wood. These species, along with other sources of valuable precious wood in Madagascar, including more than 70 additional members of *Diospyros* (Lowry et al., 2024) as well as 56 species of *Dalbergia* L. f. (*Fabaceae*) (Phillipson et al., 2023), the source of rosewood and palissander, have been subjected to illegal and unsustainable harvest (Mason et al., 2016) prompting CITES to place them on its Appendix II, thereby forbidding international trade. We have therefore withheld detailed locality information and refrained from providing distribution maps for these taxa, and we have masked geo-coordinate data in the on-line sources Tropicos and the *Catalogue of the Plants of Madagascar* (Madagascar Catalogue, 2024). For those species of smaller stature, for which collection data are provided, geo-coordinates calculated *post facto* for older collections are placed in square brackets.

Key to the species of the Tetraclis group of Diospyros

1. Leaf blades coriaceous, stiff 2
1a. Leaf blades membranaceous, chartaceous, or subcoriaceous, flexible 13

2. Leaves opposite ..... 13. ***D. parifolia***
2a. Leaves alternate or whorled 3

3. Blade of the largest leaf at least 14 cm long (rarely slightly shorter in *D. baronii* and *D. fuscovelutina*); NW and E Madagascar 4
3a. Blade of largest leaf no more than 12.5 cm long (rarely to 14 cm in *D. vescoi*); extreme N or SE Madagascar 9

4. Mature leaves with glabrous abaxial surface (rarely with very sparse indument in *D. baronii*) 5
4a. Mature leaves with persistent, evident indument on abaxial surface (rarely sparse in *D. fuscovelutina*) 6

5. Petiole 1–2 cm long; blade of the largest leaf 2–5 cm wide; fruiting calyx 5-lobed, adaxial surface with horizontal striations; axes of male inflorescences with dense, ferruginous indument; Antalaha to Nosy Varika ..... 4. ***D. baronii***
5a. Petiole 2.5–3.5 cm long; blade of the largest leaf 6–8 cm wide; fruiting calyx 4-lobed, adaxial surface smooth or with vertical striations; axes of male inflorescences with sparse, short, light gray indument; Sambirano (Ambanja, Nosy Be, Galoka, Tsaratanana), Antsirabe Nord, Masoala ..... 6. ***D. clusiifolia***

6. Leaf apex with an evident mucro 7
6a. Leaf apex lacking an evident mucro 8

7. Fruiting calyx lobes rounded, with a minute apical tooth; fruit surface smooth; Sambirano (Ambanja, Ampasindava, Ambato) ..... 1. ***D. ambanjensis***

7a. Fruiting calyx lobes triangular, apex acute; fruit surface verrucose; central E coast (Analalava, forêt de Mangalimaso) ..... 2. ***D. analalavensis***

8. Petiole 1.5–2 cm long; adaxial surface of leaves drying khaki green; fruit apex rostrate or rounded; Makirovana (Sambava area) to Sahafina (Toamasina area) ..... 10. ***D. fuscovelutina***

8a. Petiole 2–3.5 cm long; adaxial surface of leaves drying brown; fruit apex rounded to somewhat flattened; Sambirano (Ambato, Galoka) ..... 15. ***D. sambiranensis***

9. Plants glabrous throughout; Tsitongambarika and Andohahela (Tolagnaro area) ..... 11. ***D. mimusops***

9a. Plants with at least some evident indument on the twigs and petioles, and usually on the midvein on the abaxial surface of the leaf 10

10. Leaf apex lacking a distinct mucro; blade obovate to widely obovate, sometimes elliptic, no more than 2.5(–2.75) times longer than wide 11

10a. Leaf apex with a distinct mucro; blade narrowly elliptic (sometimes slightly ovate or obovate), at least (2.85–)3 times longer than wide 12

11. Abaxial surface of leaves with curly, tangled, erect, rusty trichomes 1 mm long; lobes of calyx in fruit broadly triangular, 10–12 × 20–22 mm ..... 3. ***D. antsirananae***

11a. Abaxial surface of leaves with straight, semi-appressed, light brown trichomes 0.5 mm long; lobes of calyx in fruit triangular, 5–7 × 6–7 mm ..... 18. ***D. vescoi***

12. Margins of calyx lobes in fruit strongly undulate; male flowers borne in pseudo umbels; forêt d'Ambondro-Ampasy (N of Mahajanga), Namoroka, Beanka, Bemaraha ..... 16. ***D. undulaticalyx***

12a. Margins of calyx lobes in fruit flat, not undulate; male flowers borne singly or in pairs or triads directly on the branches; N Madagascar ..... 17. ***D. urschii***

13. Leaf apex lacking an evident mucro 14

13a. Leaf apex with an evident mucro 17

14. Leaves glabrous, adaxial surface shiny, largest blade at least 15 cm long; humid forest, Sambirano (Ambanja, Nosy Be, Galoka, Tsaratanana), Antsirabe Nord, Masoala, Tsitongambarika (Tolagnaro area), Mandritsara ..... 6. ***D. clusiifolia***

14a. Leaves with evident indument (at least when young), adaxial surface not shiny, largest blade no more than 12(–13.5) cm long; dry or humid forest 15

15. Midvein of leaf blade distinctly channeled on adaxial surface; humid forest, Kalobinono and Loky-Manambato to Betampona ..... 14. ***D. rakotovaoi***

15a. Midvein of leaf blade flat to slightly sunken on adaxial surface; dry forest 16

16. Leaf blade oblanceolate to obovate, (2.25–)2.5–7.5 times as long as wide; S Madagascar, Makay to Cap Sainte Marie, E to Sainte Luce (Tolagnaro area) ..... 8. ***D. erythrosperma***

16a. Leaf blade widely obovate, sometimes elliptic, 1.1–2.3 times as long as wide; N Madagascar ..... 18. ***D. vescoi***

17. Key emphasizing fruiting material 18

17a. Key emphasizing material with male flowers (unknown in *D. beberonnii* from Andohahela National Park) 25

18. Mature fruits at least (2.5–)3 cm in diam. 19

18a. Mature fruits to 2(–2.3) cm in diam. 20

19. Margins of fruiting calyx lobes extending 3–6 mm below the sinuses onto the calyx cup containing the fruit; Farankaraina Forestry Station, Nosy Mangabe ..... 9. ***D. farankarainensis***

19a. Margins of fruiting calyx lobes extending no more than 1 mm below the sinuses onto the calyx cup containing the fruit; Kalobinono and Loky-Manambato S and E to Betampona ..... 14. ***D. rakotovaoi***

20. Margins of calyx lobes in fruit strongly undulate; dry forest, Ambondro-Ampasy (N of Mahajanga), Namoroka, Beanka, Bemaraha ..... 16. ***D. undulaticalyx***

20a. Margins of calyx lobes in fruit flat or revolute, not undulate; dry forest in N Madagascar or evergreen forest in E Madagascar 21

21. Trichomes on twigs, fruits, and often leaf margins 2.5–3 mm long ..... 17. ***D. urschii***

21a. Trichomes on twigs, fruits, and often leaf margins not exceeding 1.1 mm long 22

22. Calyx lobes of mature fruit with revolute margins; Sorata S to Anjanaharibe-Sud ..... 12. ***D. mucronata***

22a. Calyx lobes of mature fruit flat margins, not revolute 23

23. Pedicels in fruit with light brown, appressed trichomes c. 0.5 mm long, only partially obscuring the surface; fruits solitary or 2–4 in a short corymbose infructescence; Marotandrano to Zahamena ..... 19. ***D. zahamenensis***

23a. Pedicels in fruit with erect, orange-brown trichomes, 0.5–0.7 mm long, completely obscuring the surface; fruits always solitary 24

24. Mature fruit ellipsoid to nearly spherical, 16–17 × 15–17 mm, surface verrucose, initially densely covered with appressed, orange-brown trichomes to 1.1 mm long, glabrescent (or rubbing off) except at the rounded apex and toward the

base where protected by the calyx; distal abscission zone of the fruiting pedicel 3.8–4.3 mm in diam.; Andohahela National Park ..... 5. ***D. beberonnii***

24a. Mature fruit ellipsoid, 25–38 × 20–25 mm, apex rounded, surface smooth, obscured by dense, semi-erect, wavy light brown trichomes c. 0.4–0.8 mm long, obscuring the surface of the fruit; distal abscission zone of the fruiting pedicel (5–)6.5–8.5 mm in diam.; Baie d'Antongil area S to Manombo ..... 7. ***D. crassipedicellata***

25. Male flowers solitary or borne in pairs or triads directly on the branches, lacking a peduncle; N Madagascar ..... 17. ***D. urschii***

25a. Male flowers borne in cymules or pseudo-umbels, with a distinct peduncle (male material of *D. beberonnii* unknown) 26

26. Pedicels slender, to c. 0.5 mm in diam. 27

26a. Pedicels robust, at least (1.5–)2 mm in diam. 28

27. Male flowers borne in pseudoumbels; Ambondro-Ampasy (N of Mahajanga), Namoroka, Beanka, Bemaraha ..... 16. ***D. undulaticalyx***

27a. Male flowers borne in cymules; Marotandrano S to Zahamena ..... 19. ***D. zahamenensis***

28. Longest pedicel of male flowers < 1 mm long 29

28a. Longest pedicel of male flowers 7–18 mm long 30

29. Leaves with an acuminate apex; central E (Farankaraina, Nosy Mangabe) ..... 9. ***D. farankarainensis***

29a. Leaves with a rounded to acute apex; Sorata S to Anjanaharibe-Sud ..... 12. ***D. mucronata***

30. Young stems with straight, appressed trichomes c. 0.4–0.8 mm long; petioles 3–8 mm long, c. 1 mm in diam.; Baie d'Antongil area S to Manombo, mostly 0–200(–1000) m elevation ..... 7. ***D. crassipedicellata***

30a. Young stems with slightly curly, erect trichomes c. 0.5 mm long; petioles 5–15 mm long, > 1 mm in diam.; Kalobinono and Loky-Manambato S to Betampona, 600–1400 m elevation ..... 14. ***D. rakotovaoi***

Clé d'identification des espèces de Diospyros du groupe Tetraclis

1. Limbes coriaces, rigides 2

1a. Limbes membraneux, charnus ou subcoriaces, flexibles 13

2. Feuilles opposées; forêt sèche, N et O Madagascar ..... 13. ***D. parifolia***

2a. Feuilles alternes ou verticillées 3

3. Limbe de la plus grande feuille mesurant au moins 14 cm de long (rarement un peu plus court chez *D. baronii* et *D. fuscovelutina*); NO et E Madagascar 4

3a. Limbe de la plus grande feuille ne dépassant pas 12,5 cm de long (rarement atteignant 14 cm chez *D. vescoi*); extrême N ou SE Madagascar 9

4. Feuilles développées à surface inférieure glabre (rarement à indument très clairsemé chez *D. baronii*) 5

4a. Feuilles développées avec de l'indument persistant et évident sur la face inférieure (rarement clairsemé chez *D. fuscovelutina*) 6

5. Pétiole 1–2 cm de long; limbe de la plus grande feuille 2–5 cm de large; calice fructifère à 5 lobes, surface adaxiale avec des stries horizontales; axes des inflorescences mâles avec de l'indument dense et ferrugineux; Antalaha à Nosy Varika ..... 4. ***D. baronii***

5a. Pétiole de 2,5–3,5 cm de long; limbe de la plus grande feuille de 6–8 cm de large; calice fructifère à 4 lobes, surface adaxiale lisse ou avec des stries verticales; axes des inflorescences mâles avec de l'indument clairsemé, court, gris clair; Sambirano (Ambanja, Nosy Be, Galoka, Tsaratanana), Antsirabe Nord, Masoala ..... 6. ***D. clusiifolia***

6. Apex de la feuille avec un mucron évident 7

6a. Apex de la feuille sans mucron évident 8

7. Lobes du calice fructifère arrondis, avec une petite dent apicale; surface du fruit lisse; Sambirano (Ambanja, Ampasindava, Ambato) ..... 1. ***D. ambanjensis***

7a. Lobes du calice fructifère triangulaires, apex aigu; surface du fruit verruqueuse; centre de la côte est (Analalava, forêt de Mangalimaso) ..... 2. ***D. analalavensis***

8. Pétiole de 1,5–2 cm de long; face adaxiale des feuilles vert kaki en herbier; apex du fruit rostré ou arrondi; Makirovana (Sambava) à Sahafina (Toamasina) ..... 10. ***D. fuscovelutina***

8a. Pétiole de 2–3,5 cm de long; face adaxiale des feuilles brun en herbier; apex du fruit arrondi à quelque peu aplati; Sambirano (Ambato, Galoka) ..... 15. ***D. sambiranensis***

9. Plantes glabres sur toute la surface; Tsitongambarika et Andohahela (Tolagnaro) ..... 11. ***D. mimusops***

9a. Plantes présentant au moins un peu d'indument évident sur les rameaux et les pétioles, et généralement sur la nervure centrale de la face inférieure de la feuille 10

10. Apex de la feuille dépourvu de mucron distinct; limbe obovale à largement obovales, parfois elliptique, pas plus de 2,5(–2,75) fois plus long que large; N Madagascar 11

10a. Apex de la feuille avec un mucron distinct; limbe étroitement elliptique (parfois légèrement ovale ou obovale), au moins (2,85–)3 fois plus long que large 12

11. Face inférieur des feuilles avec des trichomes dressés, bouclés, entremêlés, 1 mm de long, de couleur roux; lobes du calice fructifère largement triangulaires, 10–12 × 20–22 mm ..... 3. ***D. antsirananae***

11a. Face inférieur des feuilles avec des trichomes semi-apprimé, droits, c. 0,5 mm de long, de couleur brun clair; lobes du calice fructifère triangulaires, 5–7 × 6–7 mm ..... 18. ***D. vescoi***

12. Marges des lobes du calice fructifère fortement ondulées; fleurs mâles en pseudo-ombelles; forêt d'Ambondro-Ampasy (N de Mahajanga), Namoroka, Beanka, Bemaraha ..... 16. ***D. undulaticalyx***

12a. Marges des lobes du calice fructifère droites, non ondulées; fleurs mâles isolées, en paires ou en triades portées directement sur les branches; N Madagascar ..... 17. ***D. urschii***

13. Apex de la feuille dépourvu d'un mucron évident 14

13a. Apex de la feuille avec un mucron évident 17

14. Feuilles glabres, surface adaxiale brillante, plus grand limbe au moins 15 cm de long; forêt humide, Sambirano (Ambanja, Nosy Be, Galoka, Tsaratanana), Antsirabe Nord, Masoala, Tsitongambarika (zone Tolagnaro), Mandritsara ..... 6. ***D. clusiifolia***

14a. Feuilles à indument évident (du moins à l'état juvénile), surface adaxiale non brillante, le plus grand limbe ne dépassant pas 12(–13,5) cm de long; forêt sèche ou humide 15

15. Nervure centrale nettement canaliculée (imprimée) sur la face adaxiale du limbe foliaire; forêt humide, Kalobinono et S de Loky-Manambato vers le sud et l'est jusqu'à Betampona ..... 14. ***D. rakotovaoi***

15a. Nervure centrale plate (aplatie) à légèrement imprimée sur la face adaxiale du limbe foliaire; forêt sèche 16

16. Limbe foliaire oblancéolé à obovale, (2,25–)2,5–7,5 fois plus long que large; S Madagascar, Makay au Cap Sainte Marie, E jusqu'à Sainte Luce (Tolagnaro) ..... 8. ***D. erythrosperma***

16a. Limbe foliaire largement obovale, parfois elliptique, 1,1–2,3 fois plus long que large; N Madagascar ..... 18. ***D. vescoi***

17. Clé mettant l'accent sur le matériel fructifère 18

17a. Clé mettant l'accent sur le matériel avec des fleurs mâles (inconnues chez *D. beberonnii* du parc national d'Andohahela) 25

18. Fruits matures d'au moins (2,5–)3 cm de diam. 19

18a. Fruits matures jusqu'à 2(–2,3) cm de diam. 20

19. Marges des lobes du calice fructifère s'étendant de 3–6 mm en dessous des sinus sur la coupe du calice contenant le fruit; station forestière de Farankaraina, Nosy Mangabe ..... 9. ***D. farankarainensis***

19a. Marges des lobes du calice fructifère ne s'étendant pas de plus de 1 mm en dessous des sinus sur la coupe du calice contenant le fruit; Kalobinono et Loky-Manambato vers le S et l'E jusqu'*à Betampona* ..... 14. ***D. rakotovaoi***

20. Marges des lobes du calice fructifère fortement ondulées; forêt sèche, Ambondro-Ampasy (N Mahajanga), Namoroka, Beanka, Bemaraha ..... 16. ***D. undulaticalyx***

20a. Marges des lobes du calice fructifère droites ou révolutées, non ondulées; forêt sèche N Madagascar ou forêt dense humide E Madagascar 21

21. Trichomes sur les rameaux, les fruits et souvent les bords des feuilles longs de 2,5–3 mm; N Madagascar ..... 17. ***D. urschii***

21a. Trichomes sur les rameaux, les fruits et souvent les bords des feuilles ne dépassant pas 1,1 mm de long; E, C, et S de Madagascar (Andohahela NP) 22

22. Lobes du calice des fruits mûrs à marge révolutée; de Sorata vers le S jusqu'à Anjanaharibe-Sud ..... 12. ***D. mucronata***

22a. Lobes du calice du fruit mûr à marge droite, non révolutée 23

23. Pédicelles fructifères avec des trichomes brun clair, apprimés, c. 0,5 mm de long, ne masquant que partiellement la surface; fruits solitaires ou par 2–4 en une courte infrutescence en corymbe; de Marotandrano à Zahamena ..... 19. ***D. zahamenensis***

23a. Pédicelles fructifères avec des trichomes érigés, brun-orangés, 0,5–0,7 mm de long, obscurcissant complètement la surface; fruits toujours solitaires 24

24. Fruit mûr ellipsoïde à presque sphérique, 16–17 × 15–17 mm, surface verruqueuse, initialement densément couverte de trichomes brun-orangés apprimés jusqu'à 1,1 mm de long, glabrescente (ou l'indument se détachant) sauf au niveau de l'apex arrondi et vers la base protégée par le calice; zone d'abscission distale du pédicelle fructifère de 3,8–4,3 mm de diam.; Parc National d'Andohahela ..... 5. ***D. beberonnii***

24a. Fruit mûr ellipsoïde, 25–38 × 20–25 mm, apex arrondi, surface lisse, obscurée par des trichomes denses, semi-dressés, ondulés, brun clair, c. 0,4–0,8 mm de long, obscurcissant la surface du fruit; zone d'abscission distale du pédicelle fructifère (5–)6,5–8,5 mm de diam.; de la zone de la Baie d'Antongil au S jusqu'à Manombo ..... 7. ***D. crassipedicellata***

25. Fleurs mâles solitaires ou en paires ou triades directement sur les branches, sans pédoncule; N Madagascar ..... 17. ***D. urschii***

25a. Fleurs mâles en petites cymes ou en pseudo-ombelles, avec un pédoncule distinct (matériel mâle de *D. beberonnii* inconnu) 26

26. Pédicelles minces, jusqu'à c. 0,5 mm de diam. 27

26a. Pédicelles robustes, au moins (1,5–)2 mm de diam. 28

27. Fleurs mâles en pseudo-ombelles; forêt d'Ambondro-Ampasy (N Mahajanga), Namoroka, Beanka, Bemaraha ..... 16. ***D. undulaticalyx***

27a. Fleurs mâles en petites cymes; de Marotandrano au S jusqu'à Zahamena ..... 19. ***D. zahamenensis***

28. Pédicelle le plus long des fleurs mâles < 1 mm de long 29

28a. Pédicelle le plus long des fleurs mâles 7–18 mm de long 30

29. Feuilles à apex acuminé; centre E (Farankaraina, Nosy Mangabe) ..... 9. ***D. farankarainensis***

29a. Feuilles à apex arrondi à aigu; de Sorata au S jusqu'à Anjanaharibe-Sud ..... 12. ***D. mucronata***

30. Jeunes tiges avec des trichomes droits et apprimés c. 0,4–0,8 mm de long; pétioles de 3–8 mm de long, c. 1 mm de diam.; de la zone de la Baie d'Antongil au S jusqu'à Manombo principalement entre 0–200(–1000) m d'altitude ..... 7. ***D. crassipedicellata***

30a. Jeunes tiges avec des trichomes légèrement frisés et dressés c. 0,5 mm de long; pétioles de 5–15 mm de long, > 1 mm de diam.; à Kalobinono, de Loky-Manambato vers le S jusqu'à Betampona, 600–1400 m d'altitude ..... 14. ***D. rakotovaoi***

Taxonomy

1. ***Diospyros ambanjensis*** G.E. Schatz & Lowry in Candollea 76: 202. 2021 (Fig. 1A).

Holotypus: Madagascar. Reg. DIANA [Prov. Antsiranana]: forêt de Bekalanoro, 19.IX.2013, fr., *Rasoanaivo 93* (MO-6857393!; iso-: G [G00341884]!, P [P01047888]!, TAN!).

Tree 6–16 m tall, 12–30 cm DBH. *Stem* shoot apex densely covered with numerous (c. 80) cataphylls prior to extension. *Leaves* alternate, lamina 11–37 × 2.4–5.5 cm, narrowly oblanceolate, coriaceous, sparsely covered on adaxial surface with erect, golden to fauve trichomes c. 0.8–1.2 mm long, more densely along the midvein, or glabrous, sometimes drying somewhat glaucous, initially rather densely covered on abaxial surface with erect, golden to fauve trichomes, more densely along the midvein, glabrescent, base long attenuate and slightly decurrent along petiole, margin revolute, apex acute to rounded, with a distinct mucron to 6 mm long; secondary veins 13–23 per side; petiole 8–15 mm long, 2–3 mm in diam. *Male flowers* borne in axillary, 3–7-flowered cymose to pseudo-umbellate inflorescences, the main axis (peduncle) 15–40 mm long, 0.5–1 mm in diam., densely covered with erect, fauve trichomes c. 1.5–2 mm long, pedicel 3–6 mm long, 1–1.5 mm in diam.; calyx 4-lobed, the lobes triangular, 1–2 × 2–3 mm, densely covered with semi-erect, fauve trichomes c. 0.2–0.3 mm long; corolla 4-lobed, the lobes valvate; stamens 26, subsessile, attached to the corolla at two levels, anthers 2–3 mm long, narrowly sagittate. *Female flowers* solitary, axillary, sessile to subsessile; calyx 4-lobed, the lobes broadly triangular to ovate, 3–5 × 5–7 mm, corolla 4-lobed, the lobes valvate, triangular, 2–3 × 3–4 mm, styles 3 mm long, stigma irregularly lobed and flattened; ovules 8. *Fruits* axillary, solitary, sessile to subsessile, abscission zone c. 4.5 mm in diam.; fruiting calyx accrescent, 14–16 mm long, expanding to c. 25 mm in diam., abaxial surface densely covered with very short, erect, fauve trichomes c. 0.5–0.8 mm long, the lobes 4, rounded triangular, 16–21 × 13–19 mm, appressed to the fruit surface, margins flat, apex rounded, with an indistinct apical tooth; fruit spherical to slightly ellipsoid, 35–40 mm in diam., apex rounded, surface smooth, initially densely covered with appressed and erect, fauve trichomes c. 1–1.5 mm long, glabrescent except for the areas protected by the calyx.

Vernacular names. – "Hazojoby" (*Rasoanaivo 93*), "Mapingo" (*Service Forestier 10640*).

Distribution and ecology. – *Diospyros ambanjensis* is known from the Ampasindava and Ambato peninsulas and from Ankitsika (Madagascar Catalogue, 2024), all of which are located in the Sambirano region of northwestern Madagascar. It occurs in low-elevation subhumid forest up to 450 m.

Phenology. – Material of *Diospyros ambanjensis* has been collected in flower in September through December, and fruits have been collected in September.

Conservation status. – *Diospyros ambanjensis* has a geographic range in the form of an extent of occurrence (EOO) of 2,154 km^2 and a minimum area of occupancy (AOO) of 24 km^2. It is present in the Ampasindava protected area, and is threatened there and elsewhere in its range by forest clearing for agriculture, fire, grazing, and exploitation for firewood and house construction material, all of which are projected to result in continuing decline in EOO, AOO, quality of habitat, number of locations or subpopulations, and number of mature individuals. With respect to the most serious plausible threat of forest clearing for agriculture, *D. ambanjensis* exists at five locations. Despite new occurrences recorded since publication of a recent assessment on the IUCN Red List (Schatz & Lowry, 2021a), the updated assessment presented here for *D. ambanjensis* remains unchanged as "Endangered" [EN B1a b(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)].

Notes. – Within the Tetraclis group, *Diospyros ambanjensis* is one of five species with large leaves, often exceeding 20 cm in length, a feature shared with *D. analalavensis* (here described), *D. baronii*, *D. clusiifolia*, and *D. fuscovelutina* Baker (see below). It can, however, be distinguished from these other taxa by its spiral to pseudo-verticillate phyllotaxy, and the shoot apex bearing numerous cataphylls prior to extension, which leave

evident scars after falling (see Schatz et al., 2021b, fig. 1). *Diospyros ambanjensis* is a large tree species and therefore a potential source of ebony (Lowry et al., 2024), so precise locality information has been withheld.

Additional specimens examined. – Madagascar. **Reg. DIANA [Prov. Antsiranana]:** Ampasindava, forêt de Betsitsika, 4.XI.2009, ♂ fl., *Gautier et al. 5309* (G, P); Ambato Forêt Classée, 22.XI.1996, ♀ fl., *Randrianaivo et al. 24* (MO, P, TAN); Ankitsika, Ambanja, 8.IX.1954, ♂ fl., *Service Forestier 10640* (P, TEF); Ampasindava, forêt de Bongomihiravavy, 13.XII.2008, ♂ fl., *Tahinarivony et al. 211* (G, P, TEF).

2. ***Diospyros analalavensis*** Lowry, G.E. Schatz, A.G. Linan & H.N. Rakouth, **sp. nov.** (Fig. 1B, 2).

Holotypus: Madagascar. Reg. Atsinanana [Prov. Toamasina]: forêt de Mangalimaso, W de Foulpointe, [17°41'S 49°29'E], 18.XII.1967, *Service Forestier 28066* (P [P03829424]!; iso-: G!, MO-6813111!, P [P00722727]!, TEF, W!).

Diospyros analalavensis Lowry, G.E. Schatz, A.G. Linan & H.N. Rakouth can be distinguished from the species it most closely resembles vegetatively, D. ambanjensis G.E. Schatz & Lowry, by its long petioles (20–40 mm vs. 8–15 mm) as well as its triangular fruiting calyx lobes with acute apices (vs. rounded) and verrucose fruit surface (vs. smooth).

Tree 8–15 m tall, 10–15 cm DBH. *Stem* shoot apex without numerous cataphylls prior to extension, young stems densely covered with straight, erect, dark brown trichomes c. 0.5 mm long. *Leaves* alternate, lamina 10.5–23 × 2.5–5.5 cm, obovate to elliptic, coriaceous (young leaves not seen), adaxial surface shiny, nearly glabrous but with sparse indument concentrated along the midvein, abaxial surface sparsely covered with semi-erect, gray to brown trichomes 1–1.2 mm long, concentrated along the midvein, base attenuate, margin revolute and sparsely ciliate, apex rounded, with a distinct mucron 2–4 mm long, midvein slightly impressed on adaxial surface, distinctly raised on abaxial surface, venation weakly brochidodromous, secondary veins 14–18 per side, slightly raised on both surfaces; petiole 20–40 mm long, 3–4 mm in diam., densely pubescent with indument trichomes as lamina. *Male flowers* borne in axillary, pseudo-umbellate inflorescences composed up to 9 flowers, the main axis (peduncle) 35–43 mm long, 0.5–1.5 mm in diam., densely covered with erect, straight, rusty trichomes 0.2–0.3 mm long, pedicel 3–4 mm long, c. 1 mm in diam., densely covered with rusty trichomes 0.2–0.3 mm long; calyx cupuliform, densely covered with appressed rusty trichomes 0.2–0.3 mm long, united portion c. 1.5 mm long, c. 4 mm in diam., calyx lobes 4, rounded triangular, c. 1.5 × 2.5 mm; corolla fleshy, cupuliform, corolla tube 3–4 mm long, densely covered outside with appressed, golden trichomes c. 1 mm long, glabrous inside, corolla lobes 4, valvate, 4 × 2–2.5 mm, rounded-triangular, apex acute; stamens 16–18, subsessile, attached to the corolla at two levels, 5–6 mm above the base and 0.5 mm higher, anthers 2.5–3 mm long, narrowly ovoid, apically dehiscent; pistillode discoid, 1–1.5 mm long, 2–2.5 mm in diam., densely covered with straight, erect, golden trichomes 0.5–0.75 mm long. *Female flowers* not seen. *Fruits* axillary, solitary, sessile, abscission zone 6–7 mm in diam.; fruiting calyx accrescent, cupuliform, covered with straight, grayish, appressed trichomes 1 mm long, glabrescent, the united portion 7–14 × 2–2.5 mm, the lobes 4, rounded-triangular to triangular, 16–20 × 15–20 mm, appressed to the fruit surface, margins flat along the entire length, apex acute; fruit 4-locular, ovoid to ellipsoid, 35–39 × 27–32 mm, the apex rounded to broadly acute, surface verrucose, glabrous. *Seeds* not seen.

Etymology. – The name chosen for this species reflects the fact that the only known extant population occurs at the Analalava reserve, one of 11 community-based protected areas managed by the Missouri Botanical Garden's Madagascar Program.

Vernacular names. – "Hazomafana" (*Gervais 198*, *397*), "Hazomainty" (*Bernard 2262*).

Distribution and ecology. – *Diospyros analalavensis* is known from two sites, Analalava and Mangalimaso (Fig. 3), both located in the Atsinanana region of eastern Madagascar, although it has not been observed at the second site since 1967. It occurs in low elevation humid forests, on sandy soils with abundant humus, up to 50 m elevation.

Phenology. – Flowering material has been collected in March; fruiting collections have been recorded in April.

Conservation status. – *Diospyros analalavensis* has a restricted geographic range in the minimum AOO of 8 km² (within the limits for Critically Endangered status under the criterion B2). The species is present at the Analalava protected area, which it is well managed but nevertheless potentially subjected to forest degradation due to fire and selective exploitation, which could result in continuing decline in habitat quality and the number of mature individuals. The second historically documented occurrence, located at the unprotected Mangalimaso forest, has not been observed since 1967 and is presumed to have been extirpated. The species thus exists at a single location with respect to the most serious plausible threat, forest degradation due to fire. Therefore, *D. analalavensis* is provisionally assessed as "Critically Endangered" [CR B2ab(iii,v)].

Notes. – Like the previous species, *Diospyros analalavensis* is another member of the Tetraclis group with large leaves. It closely resembles *D. ambanjensis* in overall appearance as well as leaf size and shape, but differs in having longer petioles

(20–40 mm vs. 8–15 mm), calyx lobes in fruit with an acute (vs. rounded) apex, and fruit with a verrucose (rather than smooth) surface (Fig. 1B, 2).

Additional specimens examined. – **Madagascar. Reg. Atsinanana [Prov. Toamasina]:** Analalava, 17°42'20"S 49°27'34"E, 44 m, 27.I.2014, ster., *Bernard 2262* (BR, G, MO, P); ibid., 17°42'19"S 49°27'14"E, 45 m, 10.X.2015, ster., *Gervais 81* (MO, P, TAN); ibid., 17°42'19"S 49°27'28"E, 53m, 26.III.2019, fl., *Gervais 198* (MO, P, TAN); ibid., 17°42'29"S 49°27'25"E, 56 m, 22.IV.2020, fr., *Gervais 347* (MO, P, TAN); ibid., 17°04'19"S 49°02'28"E, 52 m, 29.IV.2023, bud, *Linan 183* (MO, P, TAN); ibid., 17°04'19"S 49°02'28"E, 33 m, 29.IV.2023, ster., *Linan 184* (MO, P, TAN).

3. ***Diospyros antsirananae*** G.E. Schatz & Lowry in Candollea 76: 210. 2021 (Fig. 1C).

Holotypus: Madagascar. Reg. DIANA [Prov. Antsiranana]: Massif de la Montagne des Français, 10.XI.1961, fr., *Service Forestier 20378* (MO-6956004!; iso-: G [G00341736]!, P [P02091756, P02091757]!, TEF [TEF000890]!, W!).

Tree 5–18 m tall, 10–25(–40) cm DBH. *Stem* shoot apex without numerous cataphylls prior to extension terete to slightly flattened, densely covered with curly, erect, whitish to brown trichomes 0.2 mm long. *Leaves* alternate, lamina 3.3–8.8 × 2–4.2 cm, obovate, sometimes elliptic, coriaceous, initially densely covered with minute, curly, erect, whitish trichomes c. 0.2 mm long on adaxial surface, glabrescent, densely covered with erect, curly, tangled, rusty trichomes 1 mm long on abaxial surface, base cuneate to rounded, margin revolute, apex acute to rounded, sometimes with a minute mucron on leaves with an acute apex, midvein impressed on adaxial surface, raised on abaxial surface, secondary veins 7–14 per side; petiole 5–10 mm long, 1.5–2 mm in diam., canaliculate. *Male flowers* borne in axillary, 3(–5)-flowered pseudo-umbellate cymes, one inflorescence per axil, axes densely covered with erect, curly, rusty trichomes 0.2 mm long, primary axis (peduncle) 18–28 mm long, pedicel 4–7 mm long, 1.5 mm in diam.; calyx 4-lobed, the lobes broadly triangular, 2 × 4.5–5 mm, densely covered outside with appressed, light brown trichomes 0.3–0.5 mm long, glabrous inside except for a ring of trichomes at the base; corolla 4-lobed, the lobes triangular; stamens c. 26, inserted on the corolla at two levels, filaments 1.5 mm long, anthers 2 mm long, oblong, apex acute, dehiscing by apical pores. *Female flowers* solitary, axillary, pedicel 1–2 mm long, 2–2.5 mm in diam.; calyx 4-lobed, the lobes ovate-triangular, 7 × 7 mm; corolla 4-lobed, the lobes valvate, broadly ovate-triangular, with a basal auricle on one side, 3 × 4 mm, styles 3 mm long, stigma flat-topped, staminodia absent. *Fruits* axillary, solitary, pedicel in fruit 3 mm long, 3 mm in diam., densely covered with semi-erect, whitish to brown trichomes 0.2–0.5 mm long, distal abscission zone 4.3–4.8 mm in diam.; fruiting calyx accrescent, broadly cupuliform, 12–15 × 25–28 mm, densely covered with semi-erect, whitish to brown trichomes 0.2–0.5 mm long, with a prominent ridge extending from the base to sinus, the lobes 4, broadly triangular, 10–12 × 20–22 mm, recurved, appressed to the fruit surface, the margins reflexed toward the sinuses, basal portion of margins of adjacent lobes pinched at the sinus, apex acute; fruit spherical to slightly obloid, 24–28 × 25–28 mm, the apex rounded or sometimes bluntly acute, surface smooth, densely covered with erect, rusty brown trichomes 2–3 mm long.

Vernacular names and uses. – "Jobiampototra" (*Randrianarivelo et al. 119*, *Nombanjanahary 243*, *261*), "Mapingo" (*Rakotoarivelo 152*), "Ombilahala" (*Bernard 2947*).

Used for house construction and artisanal woodworking (*Rakotoarivelo 152*).

Distribution and ecology. – *Diospyros antsirananae* is restricted to northern Madagascar, from Loky-Manambato protected area in the SAVA region to the extreme northern tip of the island at Cap d'Ambre and including several sites around the city of Antsiranana (Madagascar Catalogue, 2024). It occurs in dry forest and occasionally in areas of transition toward more humid forest from 50 to 500 m elevation, on sand and calcareous substrate, including karstic formations ("tsingy").

Phenology. – Flowering material has been collected in February, April through June, and December; fruiting collections have been recorded throughout most of the year.

Conservation status. – *Diospyros antsirananae* has a geographic range in the form of an EOO of 4,811 km² and a minimum AOO of 80 km². It is present in three protected areas, Andrafiamena Andavakoera, Loky-Manambato, and Montagne des Français. Both within and outside these protected areas, it is threatened by forest clearing for agriculture, fire, grazing, and exploitation for firewood and house construction material, all of which are projected to result in continuing decline. With respect to the most serious plausible threat of forest clearing for agriculture, it exists at 13 locations. Despite new occurrence records since publication of a recent assessment on the IUCN Red List (Lowry & Schatz, 2022), the updated risk of extinction assessment presented here for *D. antsirananae* remains unchanged as "Near Threatened" [NT], as it nearly qualifies for "Vulnerable" status under criteria B1 and B2.

Notes. – *Diospyros antsirananae* is one of three species in the Tetraclis group restricted to dry forests in far northern Madagascar, along with *D. urschii* H. Perrier and *D. vescoi* Hiern. It can be distinguished by the dense, erect, curly, tangled, rusty trichomes 1 mm long on the abaxial surface of the leaf lamina (see Schatz et al., 2021b, fig. 2, 5). *Diospyros antsirananae* is

a large tree species and therefore a potential source of ebony wood (Lowry et al., 2024), so precise locality information has been withheld.

Additional specimens examined. – Madagascar. **Reg. DIANA [Prov. Antsiranana]:** Montagne des Français, 7.IV.2007, fr., *Bardot-Vaucoulon 1655* (K, MO, P, TAN); Andrafiamena, 25.XI.2010, fr., *Burivalova 44* (G, MO, P, TEF); Beantely, 15.III.2022, ster., *Karatra 544* (DBEV, MO, P, TAN); ibid., bud, *Karatra 545* (DBEV, MO, P, TAN); Cap d'Ambre, XII.1966, fl., *Morat 1260* (P, TAN); Montagne des Français, 10.VIII.2007, fr., *Rakotoarivelo 152* (CNARP, MO, P, TAN); Ampitiliantsambo, 15.I.2005, fr., *Rakotonandrasana et al. 904* (CNARP, MO, P, TAN); ibid., 17.VI.2004, fr., *Ramananjanahary et al. 26* (CNARP, MO, P, TAN); Andavakoera, 8.XII.2019, ster., *Ramanitrinizaka et al. 131* (DBEV, MO, P, TAN); Montagne des Français, 24.I.2014, bud, *Randrianaivo 2456* (BR, G, MO, P, TAN); Sahafary, 25.I.2014, ster., *Randrianaivo 2465* (BR, G, MO, P); Beantely, 15.XII.2021, ster., *Randrianaivo 3922, 3923* (DBEV, MO, P, TAN); ibid., 16.III.2022, ster., *Randrianaivo et al. 4028, 4029, 4030* (DBEV, MO, P, TAN); Montagne des Français, 11.IX.2004, fr., *Randrianarivelo et al. 119* (MO, P, TAN); Montagne des Français, 22.III.2007, fr., *Ratovoson 1243* (CNARP, MO, P, TAN); Andranonakomba, 5.XII.2007, fr., *Ratovoson et al. 1433* (CNARP, G, MO, P, TAN); Montagne des Français, 24.VI.2020, ster., *Ravaomanalina 55, 56, 57, 59* (DBEV, MO, P, TAN); Analafondro, 26.VI.1964, fl., *Service Forestier 23327* (G, MO, P, TEF, W); Montagne des Français, 10.XI.1961, fr., *Service Forestier 20378* (G, MO, P, TEF); Sahafary, 24.IV.1963, fl., *Service Forestier 22700* (G, MO, P, TEF); bassin inférieur du Rodo, 26.II.1964, ster., *Service Forestier 23328* (P, TEF); plateau de Sahafary, 1.V.1966, fl., *Service Forestier 24706* (P, TEF); ibid., fl., *Service Forestier 24707* (BR, CAS, FHO, G, K, MO, NY, P, TEF, US, W, WAG). **Reg. SAVA [Prov. Antsiranana]:** Binara, 7.XII.2021, ster., *Bernard 2928* (DBEV, MO, P, TAN); Bobankora, Loky Manambato, 13.XII.2021, ster., *Bernard 2947* (DBEV, MO, P, TAN); Bekaraoka Nord, Loky-Manambato, 3.II.2019, ster., *Karatra et al. 13* (DBEV, MO, P); Ampondrabe, Loky-Manambato, 5.II.2019, ster., *Karatra 20* (DBEV, MO, P); ibid., 19.II.2019, ster., *Karatra 63* (DBEV); Andripatra, 11.X.2021, ster., *Karatra et al. 397* (DBEV, MO, P, TAN); SE of Ambilobe, 21.XII.1989, ster., *McPherson 14745A* (MO, TAN); Antsahabe, Loky Manambato, 7.XII.2021, ster., *Nombanjanahary 243* (DBEV, MO, P, TAN); Bobankora-Madirobe, Loky Manambato, 13.XII.2021, ster., *Nombanjanahary et al. 261* (DBEV, MO, P, TAN); Andripatra, 16.X.2021, ster., *Randrianaivo 3826* (DBEV, MO, P, TAN); ibid., 17.X.2021, ster., *Randrianaivo et al. 3859* (DBEV, MO, P, TAN); ibid., 18.X.2021, ster., *Randrianaivo et al. 3865, 3867, 3868, 3871* (DBEV, MO, P, TAN); Ambilondamba, 1.II.2004, fl., *Ranirison 378* (G, MO, P, TAN).

4. ***Diospyros baronii*** (H. Perrier) H.N. Rakouth & Lowry in Novon 31: 158. 2023 (Fig. 1D).

   ≡ *Tetraclis baronii* H. Perrier in Mém. Inst. Sci. Madagascar, Sér. B, Biol. Vég. 4: 96. 1952.

   Lectotypus (designated by Schatz & Lowry, 2011: 275): Madagascar. **Reg. Alaotra-Mangoro [Prov. Toamasina]:** Ambatondrazaka, XI.1938, fr., *Cours 998* (P [P00573673]!; isolecto-: K!, MO!).

Tree 5–18 m tall, 10–45 cm DBH. *Stem* shoot apex without numerous cataphylls prior to extension, young stems sparsely covered with straight, appressed, golden to whitish-brown trichomes 0.5–1 mm long, mature stems lenticellate, grayish, often glaucescent. *Leaves* alternate, lamina 12.5–29 × 2–5.3 cm, narrowly obovate to narrowly oblanceolate, coriaceous (young leaves not seen), adaxial surface glabrous or occasionally with sparse, straight, appressed, whitish-gray to light brown trichomes 0.5–1 mm long, abaxial surface nearly glabrous, with very sparse indument like that of adaxial surface, base attenuate to cuneate, margin often revolute, pubescent, apex rounded to rounded-acute, often with an obscure mucron c. 0.1 mm long, midvein impressed on adaxial surface, raised on abaxial surface, venation weakly brochidodromous, secondary veins 15–25(–29) per side, slightly raised on both surfaces; petiole 10–18 mm long, 1.5–4 mm in diam., densely covered with straight, appressed, light brown trichomes 0.5–1 mm long, glabrescent, often glaucescent. *Male flowers* (known from only immature material) borne in axillary, 3–8-flowered cymose inflorescences, the main axis (peduncle) 25–45 mm long, 1.5–2.0 mm in diam., densely covered with erect, straight, rusty trichomes < 0.5 mm long, pedicel 14–20 mm long, 1–1.5 mm in diam., densely covered with rusty trichomes < 0.5 mm long; calyx cupuliform, 3–4 × 5–6 mm, the 4 lobes triangular, 2–3 × 2–3 mm, densely covered with appressed, rusty trichomes < 0.5 mm long; corolla fleshy, cupuliform, corolla tube 7–8 mm long, densely covered outside with appressed, golden trichomes c. 0.5 mm long, corolla lobes 4, valvate, rounded-triangular, 2–3 × 2–3 mm, apex acute; stamens 25–26, 2–3.5 mm long, attached to the corolla at two levels, 2 mm above the base and c. 1 mm higher, filaments 0.5–1.5 mm, anthers 1.5–2 mm long, narrowly ovoid, apically dehiscent; pistillode discoid, 0.5–0.75 × 2–3 mm, densely covered with straight, erect, golden trichomes 0.2–0.5 mm long. *Female flowers* solitary, axillary, sessile to subsessile; calyx cupuliform, densely covered outside and inside with appressed, chocolate brown trichomes c. 0.2–0.3 mm long, united portion 5–5.5 × 11–12 mm, calyx lobes 4–5, triangular, 6 × 8 mm, apex acute; corolla ovoid, tube 6–6.5 × c. 9.5 mm, densely covered outside with appressed, light brown to whitish trichomes c. 0.2–0.3 mm long, with same indument inside, becoming glabrous toward the base, corolla lobes 4, valvate, triangular, 4 × 4 mm, staminodia absent; ovary broadly ovoid to somewhat pyriform, c. 4.5–5 × 7 mm, densely covered with erect, chocolate brown trichomes 0.5–0.75 mm long, styles not seen. *Fruits* axillary, solitary, pedicel in fruit 12–35 mm long, 1.5–3 mm in diam., densely covered with straight, erect, brownish to ferruginous trichomes < 0.5 mm long, with 6–7 alternate bract scars, distal abscission zone 5.4–6.1 mm in diam.; fruiting calyx accrescent, cupuliform, covered with dense erect, brownish or dark-brown to ferruginous indument, otherwise the same as the pedicel indument, the united portion 7–12 × 18–23 mm, the lobes 5, triangular to rounded-triangular (or wedge-shaped, i.e., like the segment of an orange), (7–)9–15 × 10–15 mm, appressed to the fruit surface, with horizontal striations on abaxial surface (giving an appearance of crossed, tabby brown to ferruginous indument), margins flat and slightly thickened, rarely revolute, apex acute to obtuse; fruit 4–5-locular, spheroid

to slightly obloid, 15–30 × 16–28 mm, the apex rounded with a stylar remnant, surface verrucose, with same indument as calyx but longer (> 0.5 mm) and persistent. *Seeds* spherical wedge-shaped (i.e., like the segment of an orange), 10–11 × 7–9 mm.

Vernacular names and uses. – "Analomanta" (*Service Forestier 7392*), "Hazomafana" (*Randrianjanaka 31, Service Forestier 2444*, *12861*, *26288*), "Hazomainty" (*Andrianarivelo 170*, *172, Bernard 2848, 2849, 2850, 2851, 2852, Rasoamanana 6, Razakamalala 8885*, *8895*, *8896*), "Hazompaniana" (*Service Forestier 19767*), "Hazovola" (*Rasoamanana 17*, *18, Razakamala 8884*), "Lavaravina" (*Randrianjanaka 31*), "Sakéala" (*Randrianasolo 962*), "Varongy mainty" (*Service Forestier 1195*), "Voaletaka" (*Service Forestier 15039*).

Used as an antidote for poisoning (*Service Forestier 12861*), for construction (*Service Forestier 15039*) and for building roofs (*Service Forestier 7392*).

Distribution and ecology. – *Diospyros baronii* can be found along the eastern coast of Madagascar, extending from the Masoala peninsula south to Mahavita (Madagascar Catalogue, 2024). It occurs in both littoral forest near the coast and humid evergreen forests further inland, often along rivers and streams up to 1500 m elevation. It is often found growing on sandy substrate.

Phenology. – Flowering material of *Diospyros baronii* has been collected from February through May, July, and September; fruiting collections have been recorded throughout most of the year from September to May and in July.

Conservation status. – *Diospyros baronii* has a geographic range in the form of a minimum EOO of 28,975 km² and a minimum AOO of 88 km². It is present in several protected areas (Analamazaotra National Park, Mananara-Nord National Park, Marolambo National Park, Masoala National Park, Nosivolo River Protected Harmonious Landscape, and Zahamena National Park). Both within some of these protected areas and outside them, the habitat of *D. baronii* is under intense human pressure from shifting agriculture, fire, logging for timber, and exploitation for firewood and charcoal production, which will likely result in projected continuing decline in EOO, AOO, habitat quality, the number of locations, and the number of mature individuals. With respect to the most serious plausible threat, forest clearing for logging and wood harvesting, *D. baronii* exists at 12 locations. While this species would qualify for threatened status under criterion B2 because its AOO is below the threshold value for Endangered status (500 km²) and it is subjected to various types of continuing decline, the number of locations slightly exceeds the upper limit for Vulnerable status (10) and its risk of extinction was recently assessed as "Near Threatened" [NT] (Rakouth et al., 2023).

Notes. – The taxon initially described as *Tetraclis baronii* was treated as a synonym of *Diospyros fuscovelutina* by Schatz & Lowry (2011), but Rakouth et al. (2023) recently showed that this was an erroneous interpretation, prompting them to resurrect this species by establishing a new combination, *D. baronii* (H. Perrier) H.N. Rakouth & Lowry. This is one of five species in the Tetraclis group with large leaves (see note above under *D. ambanjensis*). It is a large tree species and therefore a potential source of ebony (Lowry et al., 2024), so precise locality information has been withheld.

Additional specimens examined. – **Madagascar. Reg. Alaotra-Mangoro [Prov. Toamasina]:** Chutes du Maningory, 19.I.1945, fr., *Cours 2475* (MO, P, TAN); W of Andasibe (Perinet), 19.I.1986, bud, *Dorr 4583* (K, MO, P, WAG); Mahadio, 19.III.2019, ster., *Karatra 85* (DBEV, MO, P); Lahindrotra et Ranomainty, 17°45'07"S 48°43'01"E, 920 m, 8.III.2001, fr., *Rakotondrajaona 161* (MO, P, TEF); Ambinanindrano, 17.III.2019, ster., *Ramanantsialonina 61* (DBEV, MO, P); Mahadio, 19.III.2019, bud, *Ramanantsialonina 63, 64* (DBEV, G, MO, P, TAN); Zahamena, 2.III.2001, fr., *Randrianjanaka 594* (CNARP, MO, P, TEF); Manakambahiny Est, 18.II.1950, fl., *Réserves Naturelles 1938* (P); Andasibe, 25.II.1950, bud, *Service Forestier 1195* (P, TAN, TEF); ibid., fl., *Service Forestier 1196* (P). **Reg. Analanjirofo [Prov. Toamasina]:** Marofototra, 12.II.2021, fl., *Andrianarivelo 170, 172* (DBEV, MO, P, TAN); ibid., 13.II.2021, fl., *Andrianarivelo 179*, *182* (DBEV, MO, P, TAN); ibid., 20.II.2021, fl., *Andrianarivelo 207* (DBEV, G, K, MO, P, TAN); ibid., bud, *Andrianarivelo 208, 209, 210* (DBEV, G, MO, P, TAN); ibid., fl., *Bernard 2848* (DBEV, MO, P, TAN); ibid., bud, *Bernard 2849, 2851* (DBEV, MO, P, TAN); ibid., ster., *Bernard 2850, 2852* (DBEV, MO, P, TAN); S of Andranobe, 12.XI.1993, fr., *van Nek 2031* (G, MO, US); Marofototra, 11.II.2021, bud, *Nombanjanahary 46, 77* (DBEV, MO, P, TAN); ibid., fr., *Nombanjanahary 47* (DBEV, MO, P, TAN); ibid., fl., *Nombanjanahary 48* (DBEV, MO, P, TAN); ibid., fl., *Nombanjanahary 78* (DBEV, G, K, MO, P, TAN); ibid., bud, *Nombanjanahary 82, 83, 84* (DBEV, MO, P, TAN); Réserve de Mananara-Nord, 22.VII.1990, fr., *Raharimalala 1100, 2241* (P); Zahamena, 18.XII.1993, fr., *Randrianjanaka 31* (MO, P, US); Tampolo, 30 m, 8.IV.2021, ster., *Rasoamanana 6* (DBEV, MO, P, TAN); Lohantrozona, 14.IV.2021, fr., *Rasoamanana 17, 18* (DBEV, G, MO, P, TAN); entre Ambiahely et Ambitsika, 27.VII.2007, fl., *Ravelonarivo 2660* (MO, P, TAN); Marofototra, 12.IV.2021, ster., *Razakamalala 8884* (DBEV, G, MO, P, TAN); ibid., fl., fr., *Razakamalala 8885* (DBEV, G, MO, P, TAN); Ambanizana, 13.IV.2021, fr., *Razakamalala 8895, 8896* (DBEV, G, MO, TAN); Soanierana Ivongo, 27.XII.1949, fr., *Service Forestier 2444* (P, TEF); entre Andapanapondra et Maroantsoro, 22.XI.1954, fr., *Service Forestier 12861* (P, TEF); Fotsialanana, 17.II.1967, fl., *Service Forestier 26288* (P, TEF). **Reg. Atsinanana [Prov. Toamasina]:** Ambatolelo, 12.XI.2020, fr., *Antilahimena 9655* (G, MO, P, TAN); Ambinanindrano, 17.III.2019, fr., *Ramanantsialonina 58* (DBEV, G, MO, P, TAN); ibid., ster., *Ramanantsialonina 59, 60* (DBEV, MO, P); ibid., fl., *Ramanantsialonina 62* (DBEV, G, MO, P, TAN); Ambalabe, Foara Toby, 26.XI.2004, fr., *A. Randrianasolo 962* (MO, P); Ambalabe, Vodiriana, 8.II.2011, fl., fr., *A. Randrianasolo 1386* (MO, P, TAN); Nosivolo-Marolambo, 12.V.1953, fl., *Service Forestier 7392* (MO, P, TEF); Marolambo, 22.IX.1955, fl., *Service Forestier 15039* (P, TEF). **Reg. SAVA [Prov. Antsiranana]:** Ambara, 17.XII.2010, fr., *Bernard 1767* (MO, P, TAN). **Reg. Vatovavy-Fitovinany [Prov. Fianarantsoa]:** Nosy Varika, 19.V.1960, fl., fr., *Service Forestier 19767* (P, TEF). **Sine loco:** 1872, fl., *Baron 2366* (P), *Baron 2446* (P), *Baron 6047* (P).

5. ***Diospyros beberonnii*** G.E. Schatz & Lowry in Candollea 76: 214. 2021 (Fig. 1E).

Holotypus: Madagascar. **Reg. Anosy [Prov. Toliara]:** Parcelle 1 de la Reserve Naturelle d'Andohahela, 10–27.IX.1993, fr., *Randriamampionona 640* (MO-6956127!; iso-: BR!, CAS!, K!, F!, G [G00341740]!, MO-6956128!; NY!, OXF!, P [P00947799, P03829510]!, PRE!, S!, TAN!, W!, WAG!, US!).

Tree 14–20 m tall, 20–60 cm DBH. *Stem* shoot apex without numerous cataphylls prior to extension. *Leaves* alternate, lamina (3–)4–8 × 1–2.8 cm, narrowly ovate to elliptic to rarely obovate, chartaceous, initially sparsely covered with appressed whitish trichomes c. 0.8 mm long on adaxial surface, more densely so along the midvein and margin, glabrescent, sparsely covered with appressed whitish trichomes c. 0.5–0.8 mm long on abaxial surface, base cuneate to attenuate, margin flat, slightly thickened on abaxial surface, apex acute to acuminate, with a distinct mucron 1–1.5 mm long, secondary veins 10–12 per side; petiole 4–8 mm long, 1 mm in diam. *Flowers* not seen. *Fruits* axillary, solitary, pedicel in fruit 5–7 mm long, 4–5 mm in diam., very densely covered with erect, orange-brown trichomes 0.5–0.7 mm long, completely obscuring the surface, distal abscission zone 3.8–4.3 mm in diam.; fruiting calyx 5 × 12–13 mm, abaxial surface very densely covered with erect, orange-brown trichomes 0.5–0.7 mm long, the lobes 4, ovate-triangular, 6–7 × 7–8 mm, spreading, not appressed to the fruit surface, margin flat to slightly thickened, apex acute; fruit ellipsoid to nearly spherical, 16–17 × 15–17 mm, surface verrucose, initially densely covered with appressed, orange-brown trichomes to 1.1 mm long, glabrescent (or rubbing off) except at the rounded apex and toward the base where protected by the calyx, crowned by a very short style/stigma remnant < 1 mm.

Distribution and ecology. – *Diospyros beberonnii* is known only from Parcel 1 of Andohahela National Park in southeastern Madagascar, with a single collection made just outside the southwestern limit of the parcel (Madagascar Catalogue, 2024). It occurs in low-elevation humid forest, occasionally in transition areas toward drier forest up to 500 m elevation.

Phenology. – Fruiting material has been collected in March, July, and September.

Conservation status. – *Diospyros beberonnii* has a restricted geographic range in the form of an EOO of 60 km² and an AOO of 20 km². Its distribution is almost entirely contained within the Andohahela National Park, but is situated near the road that traverses Parcel 1 of this protected area and at a site just outside its southwestern limit. As a consequence, the species is threatened by forest degradation due to slash-and-burn agriculture and ongoing exploitation of trees for firewood and house construction material, all of which are projected to result in continuing decline in EOO, AOO, quality of habitat, number of locations or subpopulations, and number of mature individuals. With respect to the most serious plausible threat, exploitation of trees for firewood and house construction material, *D. beberonnii* exists at five locations. Despite new occurrences recorded since the publication of a recent assessment on the IUCN Red List (Schatz & Lowry, 2021b), the updated risk of extinction assessment presented here for *D. beberonnii* remains unchanged as "Endangered" [EN B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)].

Notes. – *Diospyros beberonnii* is one of just three members in the Tetraclis group restricted to humid forest in southeastern Madagascar, along with *D. clusiifolia* subsp. *australis* (here described) and *D. mimusops* G.E. Schatz & Lowry (see below). It can be distinguished within the group by the white trichomes on its young stems and leaves, and the overall small dimensions of its lamina [(3–)4–8 × 1–2.8 cm], fruiting calyx (5 mm long with lobes 6–7 × 7–8 mm), and fruit (13–17 mm long) (see Schatz et al., 2021b, fig. 7). It is a large tree species and therefore a potential source of ebony (Lowry et al., 2024), so precise locality information has been withheld.

Additional specimens examined. – Madagascar. **Reg. Anosy [Prov. Toliara]:** Andohahela, Parcelle 1, 16–24.III.1993, fr., *Randriamampionona 234* (MO, P, TAN); ibid., 8.VII.1994, fr., *Randriamampionona 829* (MO, P, TAN); ibid., 9.IX.2019, ster., *Razakamalala & S. Andrianarivelo 8578* (DBEV, MO, P, TAN); ibid., ster., *Razakamalala & S. Andrianarivelo 8582* (DBEV, G, K, MO, P, TAN, WAG).

6. ***Diospyros clusiifolia*** (Hiern) G.E. Schatz & Lowry in Adansonia, sér. 3, 33: 273. 2011.

≡ *Tetraclis clusiifolia* Hiern in Trans. Cambridge Philos. Soc. 12: 271. 1873.

Lectotypus (designated by Schatz & Lowry, 2011: 273): Madagascar. **Reg. DIANA [Prov. Antsiranana]:** "Nossi Be", 1840–1841, fl., fr., *Richard 388* (P [P00573668]!; isolecto-: P [P00573669]!).

Distribution and ecology. – The range of *Diospyros clusiifolia* extends from the Sambirano region across northern Madagascar to the northeastern part of the island (at the Makirovona protected area and on the Masoala Peninsula), with outlying subpopulations in the vicinity of Mandritsara and at the Tsitongambarika protected area in the far southeast, each of which is recognized as separate subspecies (Fig. 3).

Conservation status. – *Diospyros clusiifolia* has a geographic range in the form of an EOO of 172,604.84 km² (far exceeding the upper limit for "Vulnerable" status under criterion B1) and a minimum AOO of 60 km² (which falls within the limits

for "Endangered" status under criterion B2). It is present at the Galoko-Kalobinono, Lokobe, Makirovana, Masoala, Tsaratanana, and Tsitongambarika protected areas. Outside of these protected areas, and in some cases also within them, it is threatened by forest clearing for agriculture, fire, grazing, and exploitation for firewood and house construction material, all of which are projected to result in continuing decline in its EOO, AOO, quality of habitat, the number of locations or subpopulation, and number of mature individuals. With respect to the most serious plausible threat of forest clearing for agriculture, it exists at 13 locations. Therefore, *D. clusiifolia* is provisionally assessed as "Near Threatened" [NT], as it nearly qualifies for "Vulnerable" status under criterion B2.

Notes. – *Diospyros clusiifolia*, one of five species in the Tetraclis group with large leaves (see note above under *D. ambanjensis*), was originally circumscribed to include only subpopulations occurring in humid forest in the Sambirano area of northwestern Madagascar (Hiern, 1873; Perrier de la Bâthie, 1952a, b), to which a few collections from similar habitats in the northeastern part of the island were recently added (Rakouth et al., 2023). Based on our comprehensive review of material belonging to the Tetraclis group, we have further expanded its circumscription to include material from two other areas, one near Mandritsara the north-central part of the island and the other from the Tsitongambarika protected area in the far southeast (Fig. 3), each of which is recognized here as a new subspecies. While the collections from these sites are clearly related to the material heretofore assigned to *D. clusiifolia* and share a strong overall resemblance with the more northern populations, they nevertheless present clear differences, as indicated in the key provided below, which justify treating them as distinct infraspecific taxa.

Key to the subspecies of Diospyros clusiifolia

1. Pedicel and calyx of fruit with sparse, appressed, light brown indument, glabrescent; North of 15°45'S latitude ..... 6a. ***D. clusiifolia*** subsp. ***clusiifolia***
1a. Pedicel and calyx of fruit with dense, persistent, erect, dark brown or fauve indument; South of 15°45'S latitude 2
2. Calyx lobes in fruit with weakly revolute margins (only immature fruit known); Tsitongambarika (Tolagnaro area) ..... 6b. ***D. clusiifolia*** subsp. ***australis***
2a. Calyx lobes in fruit with strongly revolute margins; Mandritsara ..... 6c. ***D. clusiifolia*** subsp. ***stellaticalyx***

Clé d'identification des sous-espèces de Diospyros clusiifolia

1. Pédicelle et calice du fruit à indument clairsemé, apprimé, brun clair, glabrescent; au nord de 15°45'S latitude .... 6a. ***D. clusiifolia*** subsp. ***clusiifolia***
1a. Pédicelle et calice du fruit à indument dense, persistant, dressé, brun foncé ou fauve; au sud de 15°45' de latitude S 2
2. Lobes du calice des fruits à marges faiblement révolutées (seuls les fruits immatures sont connus); Tsitongambarika (zone Tolagnaro) ..... 6b. ***D. clusiifolia*** subsp. ***australis***
2a. Lobes du calice du fruit à marges fortement révolutées; Mandritsara ..... 6c. ***D. clusiifolia*** subsp. ***stellaticalyx***

6a. ***Diospyros clusiifolia*** subsp. ***clusiifolia*** (Fig. 1G).

Tree 10–25 m tall, 10–45 cm DBH. *Stem* shoot apex without numerous cataphylls prior to extension, young stems with sparse, straight, appressed, light brown trichomes < 0.5 mm long, mature stems lenticellate, dark brown to gray. *Leaves* alternate, lamina 10–25.5 × 4.5–8.5 cm, oblong to elliptic, rarely obovate, coriaceous (young leaves not seen), shiny and glabrous on adaxial surface, nearly glabrous on abaxial surface with sparse pubescence along the midrib, base attenuate to cuneate, margin slightly revolute, glabrous, apex rounded, lacking a mucro, midvein impressed on adaxial surface, raised on abaxial surface, venation weakly brochidodromous, secondary veins 16–25 per side, slightly raised on adaxial surface, flat on abaxial surface but visible; petiole 15–24 mm long, 1.8–2.6 mm in diam., glabrous. *Male flowers* borne in axillary, (7–)10–14-flowered compound cymose inflorescences, the main axis (peduncle) 17–20 mm long, 1.0–1.5 mm in diam., densely covered with appressed, straight, whitish to golden trichomes c. < 0.5 mm long, pedicel 4–5 mm long, 1–1.5 mm in diam., moderately covered with straight, appressed, whitish trichomes 0.2–0.3 mm long; calyx cupuliform, abaxial surface densely covered with appressed whitish trichomes 0.2–0.3 mm long, united portion 4–4.5 mm long, 8–9 mm in diam., the 4 lobes indistinct, triangular, 1.5–2 × 3 mm; corolla fleshy, cylindrical, densely covered outside and inside with appressed whitish trichomes < 0.25 mm long, corolla tube 9 mm long, the lobes 4, valvate, rounded-triangular, 2.5–3 × 3–4 mm, apex acute; stamens 36–40, subsessile, attached to the corolla in at two levels, 3 mm above the base and 2 mm higher, anthers 1.5–2 mm long, narrowly ovoid, apically dehiscent; pistillode discoid, 0.5–1 × 3.5–4 mm, densely covered with straight, erect, light brown trichomes 0.2–0.3 mm long. *Female flowers* not seen. *Fruits* axillary, solitary, sessile or pedicel in fruit to 2.5–4 mm long, 5–6 mm in diam., moderately covered with straight semi-appressed to erect light brown < 0.5 mm long trichomes, glabrescent, distal abscission zone 8.7–9.1 mm in diam.; fruiting calyx accrescent, cupuliform, sparsely covered

with indument otherwise same as pedicel trichomes, the united portion 8–12 × 20–25 mm, the lobes 4, triangular to rounded-triangular, 12–15 × 15–20 mm, appressed to the fruit surface, margins flat, becoming slightly reflexed at the sinus, appearing pinched, apex acute; fruit 4-locular, oblate-spheroid to ovoid, 25–35 × 25–32 mm, surface slightly verrucose, densely covered with straight erect to semi-appressed light brown trichomes 0.25 mm long, persistent, apex round with stylar remnant. *Seeds* spherical wedge-shaped (i.e. like the segment of an orange), 20–24 ×10–12 mm.

Vernacular names. – "Mapingo" (*Andriamiadana 68, 69, 70, 71, 72, 73, 74, 75, Antilahimena 219*), "Hazomahogo" (*Reserves Naturelles 6265*).

Distribution and ecology. – *Diospyros clusiifolia* subsp. *clusiifolia* occurs in the northern Madagascar, in the regions of DIANA, SAVA, and Sofia, with a range extending from the island of Nosy Be in the northwest to the Makirovana protected area and on the Masoala peninsula in the northeast. It occurs in low-elevation humid forest up to 200 m elevation and rarely as high as 500 m, and is reported to grow on laterite soils atop granitic bedrock.

Phenology. – Flowering material has been collected in December, February, and March; fruiting collections have been recorded throughout most of the year.

Conservation status. – *Diospyros clusiifolia* subsp. *clusiifolia* has a geographic range in the form of an EOO of 29,838 km^2 (exceeding the upper limit for "Vulnerable" status under criterion B1) and a minimum AOO of 48 km^2 (which falls within the limits for "Endangered" status under criterion B2). It is present at the Galoko-Kalobinono, Lokobe, Makirovana, and Masoala protected areas. Outside of the protected areas, and in some cases also within them, it is threatened by forest clearing for agriculture, fire, grazing, and exploitation for firewood and house construction material, all of which are projected to result in continuing decline in its EOO, AOO, quality of habitat, the number of locations or subpopulation, and number of mature individuals. With respect to the most serious plausible threat of forest clearing for agriculture, it exists at 10 locations. Therefore, *D. clusiifolia* subsp. *clusiifolia* is provisionally assessed as "Vulnerable" [VU B2ab(i,ii,iii,iv,v)].

Notes. – *Diospyros clusiifolia* subsp. *clusiifolia* can develop into large trees and is therefore a potential source of ebony (Lowry et al., 2024), so precise locality information has been withheld.

Additional specimens examined. – Madagascar. **Reg. DIANA [Prov. Antsiranana]:** Lokobe, 10.II.2021, ster., *Andriamiadana 68, 69, 71, 73, 74, 75* (DBEV, MO, P, TAN); ibid., bud, *Andriamiadana 70, 72* (DBEV, MO, P, TAN); ibid., 3.III.1994, fl., *Antilahimena 39* (MO, P, US); ibid., 24.III.1994, fr., *Antilahimena 75* (BR, MO, P, US); ibid., 27.VI.1995, fr., *Antilahimena 219* (BR, MO, P); ibid., 9.III.2011, fl., *Bidault 56* (G, MO, P, TAN); ibid., 17.XII.1991, fl., *Birkinshaw 68* (MO, WAG); ibid., 27.II.1992, fl., *Birkinshaw 120* (MO, WAG); Galoka, 14.II.2005, fr., *Callmander 301* (BR, G, K, MO, P, TEF); Lokobe, 12.I.2007, fr., *De Block 2156* (BR, K, MO, P, TAN, WAG); ibid., IX.1931, fr., *Perrier de la Bâthie 18734* (P); ibid., 28.XI.2018, ster., *Randrianaivo 3198, 3199* (DBEV, P); ibid., 28.XI.2018, fr., *Randrianaivo 3202, 3204* (DBEV, P, TAN); ibid., 9.II.2021, ster., *Randrianaivo 3617, 3618, 3619, 3626* (DBEV, MO, P, TAN); ibid., 9.II.2021, bud, *Randrianaivo 3620, 3621, 3622, 3623, 3624, 3625* (DBEV, G, MO, P, TAN); ibid., 18.VI.1995, fr., *Razafimandimbison 138* (MO, P, US); Nosy Be, 1840–1841, fr., *Richard 288* (P); Tsaratanana, 11.VIII.1954, fr., *Réserves Naturelles 6265* (MO, P, TEF); Lokobe, 13.III.1964, fl., *Service Forestier (Capuron) 23450* (MO, P, TEF). **Reg. SAVA [Prov. Antsiranana]:** Masoala, 27.IV.1994, fr., *Rahajasoa 338* (MO, P); ibid., 18.VIII.1994, fr., *Rahajasoa 414* (MO, P); Anketrabe, 16.II.2022, fr., *Ravelonarivo 5166, 5172* (MO, P, TAN); Makirovana, 27.XI.2018, ster., *Razakamalala 8237* (DBEV, P); Analamateza, 25.III.1967, fl., *Service Forestier 27567* (BR, L, MO, P, TEF, WAG). **Reg. Sofia [Prov. Mahajanga]:** Ankitsika, 8.IX.1954, fr., *Service Forestier 10639* (P); Marokitrara, 15.VIII.1952, ster., *Service Forestier 62-R-152* (P). **Sine loco:** Antsiranana, NW Madagascar, 1841, fr., *Pervillé 6* (P).

6b. ***Diospyros clusiifolia*** subsp. ***australis*** A.G. Linan, H.N. Rakouth & Lowry, **subsp. nov.** (Fig. 1F, 4).

Holotypus: Madagascar. Reg. Anosy [Prov. Toliara]: Iabokoho, Antsotso, forêt de Bemangidy, 24°35'10"S 47°09'30"E, 21 m, 2006–2008, fr., *Randriatafika 928* (2-part specimen: MO-6449227!, MO-6991912!; iso-: P [P00885646]!, TEF!).

Diospyros clusiifolia subsp. australis A.G. Linan, H.N. Rakouth & Lowry can be distinguished from the other subspecies of D. clusiifolia by the weakly revolute margins of its fruiting calyx lobes and the dense, persistent, erect, dark brown indument covering the fruiting pedicel and calyx.

Tree 7 m tall. *Stem* shoot apex without numerous cataphylls prior to extension, young stems sparsely covered with straight, appressed, light brown trichomes < 0.5 mm long, mature stems lenticellate, dark brown. *Leaves* alternate, lamina 13.5 × 4.2 cm, obovate to oblong, coriaceous, moderately densely covered with appressed, light brown trichomes c. 0.5 mm long on both surfaces, nearly glabrescent but retaining sparse indument along the midrib on abaxial surface, base attenuate to cuneate, margin slightly revolute and sparsely ciliate, apex rounded, lacking a mucro, midvein more or less flat on adaxial surface, raised on abaxial surface, venation weakly brochidodromous, secondary veins 15–18 per side, slightly raised on both surfaces; petiole 21–25 mm long, 2–3 mm in diam., indument same as on leaves but shorter (< 0.5 mm), glabrescent. *Flowers* not seen. *Fruits* (known only from immature material) axillary, solitary, pedicel in fruit 2–3 mm long, 3 mm in diam., densely covered with straight, erect, dark brown c. 0.5 mm long trichomes, distal abscission zone 3.7–3.9 mm in diam.; fruiting calyx accrescent, shallowly cupuliform, densely covered with same indument as pedicel, the united portion c. 4 × 15 mm, the lobes

4, rounded-triangular, 9–10 × 8 mm, slightly spreading and nearly appressed to the fruit surface, lacking striations, margins slightly thickened, becoming somewhat reflexed at the base, apex acute; fruit 4-locular, oblate-spheroid, c. 10 × 11 mm in diam., surface smooth, densely covered with indument like that on the pedicel, apex depressed, with 4 rounded protuberances opposite each sinus of the calyx. *Seeds* not seen.

Etymology. – The name chosen for this subspecies reflects the fact that its known geographic range lies far to the south of those of the two other subspecies of *Diospyros clusiifolia*.

Distribution and ecology. – *Diospyros clusiifolia* subsp. *australis* is known from only a single collection at Bemangidy forest located on the eastern slope of the Vohimena mountains, within the Tsitongambarika Reserve, in the Anosy region of southeast Madagascar (Fig. 3). It occurs in humid low elevation forest.

Phenology. – Unknown; the single gathering lacks information on the date of collection.

Conservation status. – *Diospyros clusiifolia* subsp. *australis* has a very restricted geographic range, with a minimum AOO of 4 km^2 (within the limits for "Critically Endangered" status under the criterion B2). The only documented occurrence is situated within the Tsitongambarika protected area, close to its boundary at a site that is threatened by slash and burn agriculture, fire, logging and wood harvesting, all of which are projected to result in continuing decline in the habitat quality and number of mature individuals. With respect to the most serious plausible threat, forest degradation from slash and burn agriculture, it exists at a single location. *Diospyros clusiifolia* subsp. *australis* is therefore provisionally assessed as "Critically Endangered" [CR B2ab(iii,v)].

Notes. – *Diospyros clusiifolia* subsp. *australis*, one of just three taxa occurring in humid forest in the far southeastern part of the island (along with *D. beberonnii* and *D. mimusops*), exhibits a remarkably disjunct distribution within the species, separated by nearly 1,000 km from the nearest subpopulation of *D. clusiifolia* subsp. *stellaticalyx* and almost 1,100 km from the nearest recorded occurrence of the typical subspecies (Fig. 3). While its leaves are indistinguishable from those of the other subspecies, it can easily be recognized by the weakly revolute margins of the calyx lobes in fruit (Fig. 1F, 4) vs. strongly revolute in the two other infraspecific taxa.

6c. ***Diospyros clusiifolia*** subsp. ***stellaticalyx*** A.G. Linan, H.N. Rakouth & Lowry, **subsp. nov.** (Fig. 1H, 5).

Holotypus: Madagascar. **Reg. Sofia [Prov. Mahajanga]:** Mandritsara, Tsarajomoka, massif de Marangibato, 4.XI.2004, fr., *Lehavana et al. 174* (MO-6060241!; iso-: P [P06664476]!, TAN!).

Diospyros clusiifolia subsp. stellaticalyx A.G. Linan, H.N. Rakouth & Lowry can be distinguished from the other subspecies of D. clusiifolia by the combination of the strongly revolute margins of its fruiting calyx lobes, giving them a rolled appearance, and the dense, persistent, erect, fauve indument covering the fruiting pedicel and calyx.

Tree 18 m tall, 20 cm DBH. *Stem* shoot apex without numerous cataphylls prior to extension, young stems sparsely covered with straight, appressed, light brown trichomes 0.5–1 mm long, mature stems lenticellate, grayish, glaucescent. *Leaves* alternate, lamina 13–16 × 5–6 cm, obovate to elliptic, coriaceous, initially moderately covered with semi-appressed light brown trichomes 0.5 mm long on both surfaces, nearly glabrescent but retaining sparse indument along the midrib on abaxial surface, base cuneate to attenuate, margin slightly revolute, sparsely ciliate, apex rounded, rarely somewhat retuse, lacking a mucro, midvein slightly impressed on adaxial surface, raised on abaxial surface, venation weakly brochidodromous, secondary veins 14–18 per side, flat on adaxial surface, slightly raised on abaxial surface; petiole 20–25 mm long, 2–3 mm in diam., covered with same indument as young stems, glabrescent. *Flowers* not seen. *Fruits* axillary, solitary, pedicel in fruit 9–11 mm long, 3–4 mm in diam., densely covered with straight erect fauve trichomes c. 0.5 mm long, distal abscission zone 7.5–7.9 mm in diam.; fruiting calyx accrescent, shallowly cupuliform, densely and persistently covered with the same indument as the pedicel, the united portion 4–5 × 15 mm, the lobes 4, rounded-triangular, 12–13 × 9 mm, with visible horizontal striations, spreading, not appressed to the fruit surface, margins strongly revolute along the entire length, appearing rolled, apex acute, often slightly mucronate; fruit 4-locular, spherical, 29–30 × 29–30 mm, the apex rounded, occasionally with stylar remnant, surface smooth, densely covered with straight persistent, erect light brown trichomes 0.5–1 mm long. *Seeds* spherical wedge-shaped (i.e. like the segment of an orange), 15 ×7 mm.

Etymology. – The name chosen for this subspecies reflects the distinctive four-pointed star shape of its fruiting calyx (Fig. 1H).

Distribution and ecology. – *Diospyros clusiifolia* subsp. *stellaticalyx* is known from two collections, one from the massif de Marangibato and the other from the forêt de Beanamafaika, both in the Sofia region of northern Madagascar (Fig. 3). It occurs in deciduous dry forest on lateritic soil at 600–750 m elevation.

Fig. 1. – Photographs of fruits of *Diospyros* L. species. **A.** *Diospyros ambanjensis* G.E. Schatz & Lowry; **B.** *Diospyros analalavensis* Lowry, G.E. Schatz, A.G. Linan & H.N. Rakouth; **C.** *Diospyros antsirananae* G.E. Schatz & Lowry; **D.** *Diospyros baronii* (H. Perrier) H.N. Rakouth & Lowry; **E.** *Diospyros beberonnii* G.E. Schatz & Lowry; **F.** *Diospyros clusiifolia* subpp. *australis* A.G. Linan, H.N. Rakouth & Lowry; **G:** *Diospyros clusiifolia* (Hiern) G.E. Schatz & Lowry subsp. *clusiifolia*; **H.** *Diospyros clusiifolia* subpp. *stellaticalyx* A.G. Linan, H.N. Rakouth & Lowry; **I.** *Diospyros crassipedicellata* G.E. Schatz & Lowry.
[**A:** *Rasoanaivo et al. 93*; **B:** *Service Forestier 28066*; **C:** *Rakotoarivelo 152*; **D:** *Antilahimena 9655*; **E:** *Randriamampionona 640*; **F:** *Randriatafika 928*; **G:** *Randrianaivo 3202*; **H:** *Lehavana et al. 174*; **I:** *Service Forestier 18318*]
[Photos: **A:** N. Solofonianja Rasoanaivo; **B:** P.P. Lowry II; **C, G:** R. Randrianaivo; **D:** P. Antilahimena; **E, F, H, I:** A.G. Linan]

Phenology. – Fruiting collections have been recorded in November.

Conservation status. – *Diospyros clusiifolia* subsp. *stellaticalyx* has a geographic range in the form of a minimum AOO of 8 km², falling within the limits for "Critically Endangered" status under criterion B2. The two known occurrences are recorded from unprotected forests where the subpopulations are subjected to forest clearing due to shifting agriculture, wildfires, and wood harvesting for subsistence, which are projected to result in continuing decline in quality of habitat quality and the number of mature individuals. With respect to the most serious plausible threat of forest clearing due to shifting agriculture, the two occurrences represent two locations. Therefore, *D. clusiifolia* subsp. *stellaticalyx* is provisionally assessed as "Endangered" [EN B2ab(iii,v)].

Notes. – While the two available collections of *Diospyros clusiifolia* subsp. *stellaticalyx* were made at sites situated less than 200 km to the west of the closest subpopulation of the typical subspecies, located at a lower elevation site on the Masoala Peninsula (Fig. 3), they are clearly distinct, in particular with regard to the morphology of the calyx in fruit.

Additional specimen examined. – **Madagascar. Reg. Sofia [Prov. Mahajanga]:** Dist. de Mandritsara, Canton d'Andohajango, forêt de Beanamafaika, 1.IV.1951, bud, *Service Forestier 18-R-158* (P).

7. ***Diospyros crassipedicellata*** G.E. Schatz & Lowry in Candollea 76: 216. 2021 (Fig. 1I).

Holotypus: Madagascar. Reg. Analanjirofo [Prov. Toamasina]: Farankaraina, 16.IX.1957, fr., *Service Forestier 18318* (MO-6956005!; iso-: G [G00341737]!, P [P00722707, P03829422]!, TEF).

Tree 6–20 m tall. *Stem* shoot apex without numerous cataphylls prior to extension, young stems moderately to densely covered with straight, appressed whitish to light brown trichomes 0.5–0.8 mm long, mature stems with small, obscure, light-colored lenticels. *Leaves* alternate, lamina 3.5–11.5 × 1.1–5 cm, elliptic to narrowly obovate to obovate, subcoriaceous to coriaceous, initially sparsely to densely covered with appressed trichomes 0.5 mm long on adaxial surface, more densely so along the midvein and margin, glabrescent, sparsely to densely covered with appressed trichomes to 0.8 mm long on abaxial surface, densely so along the midvein, base cuneate to attenuate, margin slightly thickened on abaxial surface, apex obtuse to acute to acuminate, occasionally rounded, usually with a distinct mucro 1–1.5 mm long, secondary veins 9–12 per side; petiole 3–8 mm long, 1 mm in diam. *Male flowers* borne in axillary, 2–7-flowered cymose inflorescences, 1–3 inflorescences per axil, or occasionally flowers solitary; inflorescence 5–17 mm long, the axes densely covered with erect, fauve trichomes c. 0.8–1 mm long, pedicel 3–9 mm long, 0.8–2 mm in diam.; calyx 4-lobed, the lobes triangular, 2–4 × 3–4 mm, densely covered outside with erect, fauve trichomes c. 0.8–1 mm long, glabrous inside; corolla 4-lobed, the lobes valvate, ovate-triangular, 4 × 4 mm; stamens 20, inserted in a single whorl on the corolla ⅓ from base, subsessile, anthers 1.8 mm long, apex apiculate, dehiscing by apical pores. *Female flowers* not seen. *Fruits* axillary, solitary, pedicel in fruit 8–13 mm long, 5–9 mm in diam., very densely covered with erect, orange-brown trichomes 0.5–0.7 mm long, completely obscuring the surface, distal abscission zone (5–)6.5–8.5 mm in diam.; fruiting calyx broadly cupuliform, 8–12 × 20 mm, densely covered with semi-erect, wavy light brown trichomes c. 0.4–0.8 mm long, obscuring the calyx surface, the lobes 3–4, triangular to ovate to broadly ovate, 7–13 × 12–15 mm, appressed to the fruit surface, margin flat, apex acute; fruit ellipsoid, 25–38 × 20–25 mm, apex rounded, surface smooth, obscured by dense, semi-erect, wavy light brown trichomes c. 0.4–0.8 mm long, obscuring the surface of the fruit.

Vernacular names. – "Hazomafana" (*Miandrimanana 556*), "Hazomainty" (*Andriamiarinoro 245, Rabekoloina 25, Ramanitrinizaka 199, Service Forestier 10738*).

Distribution and ecology. – *Diospyros crassipedicellata* occurs in eastern Madagascar, from Manombo reserve north to the area around the Baie d'Antongil, mostly in low-elevation humid forest near the coast, but also farther inland in mid-elevation humid forest up to 1000 m at Ambalabe and Ankerana, both of which are situated within the Corridor Ankeniheny-Zahamena protected area (Madagascar Catalogue, 2024).

Phenology. – Flowering collections have been made from January to March, and fruiting material has been collected from May to November.

Conservation status. – *Diospyros crassipedicellata* has a geographic range in the form of an EOO of 58,430 km² and a minimum AOO of 64 km². It is present in four protected areas, Analalava, Corridor Ankeniheny-Zahamena (Ambalabe and Ankerana), Masoala, and Manombo. Outside of the protected areas, and in some cases also within them, it is threatened by forest clearing for agriculture, fire, grazing, and exploitation for firewood and house construction material, all of which are projected to result in continuing decline. With respect to the most serious plausible threat of forest clearing for shifting agriculture, *D. crassipedicellata* exists at 12 locations. Thus, based on new occurrences recorded since the recent publication on the IUCN Red List of an assessment as "Vulnerable" (Schatz & Lowry, 2021c), the assessment of this species is updated to

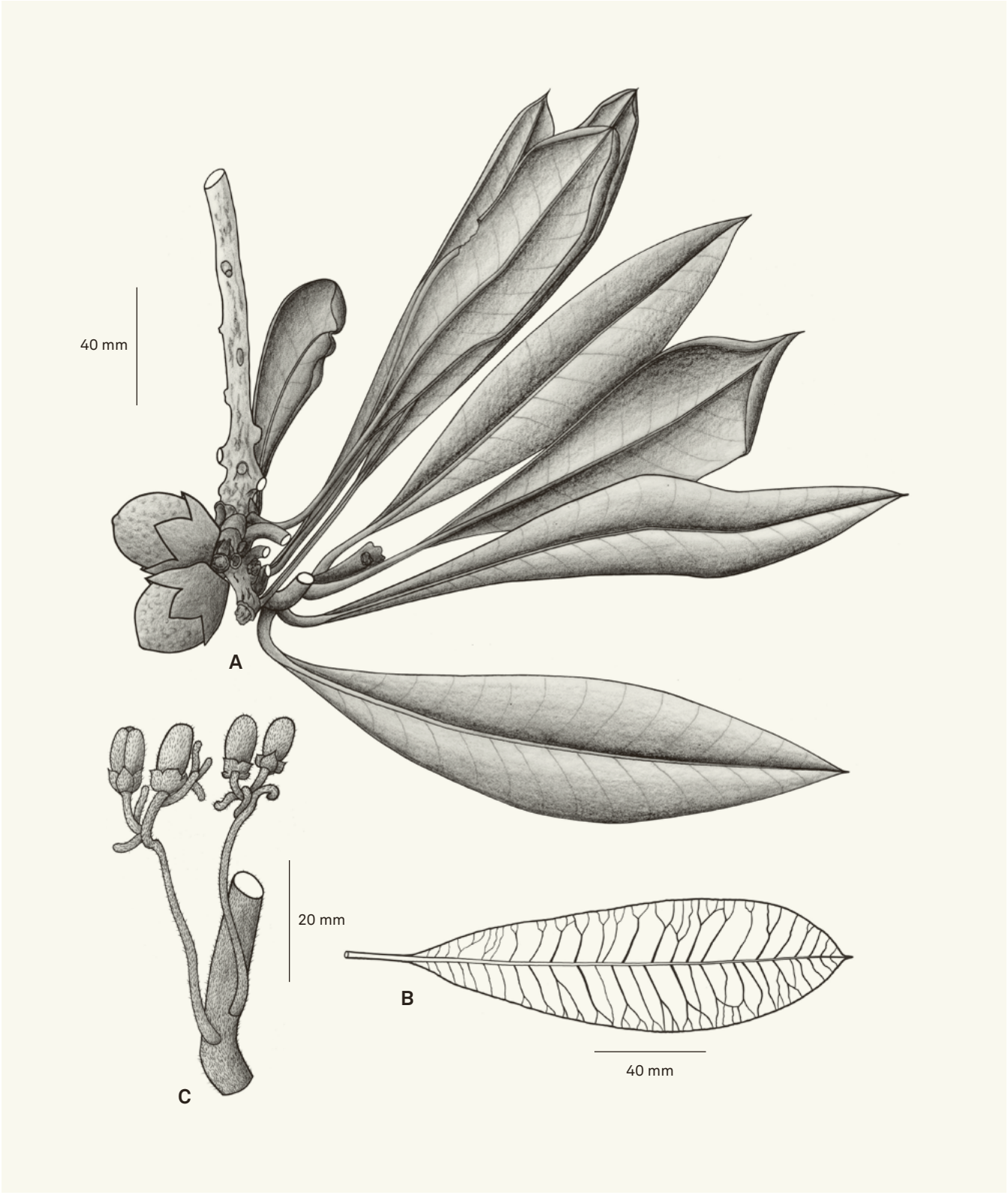

Fig. 2. – *Diospyros analalavensis* Lowry, G.E. Schatz, A.G. Linan & H.N. Rakouth. **A.** Branch with fruits; **B.** Branch with male flowers; **C.** Detail of leaf (abaxial surface).
[**A:** *Service Forestier 28066*, P; **B, C:** *Gervais 198*, P] [Drawing: Alain Jouy]

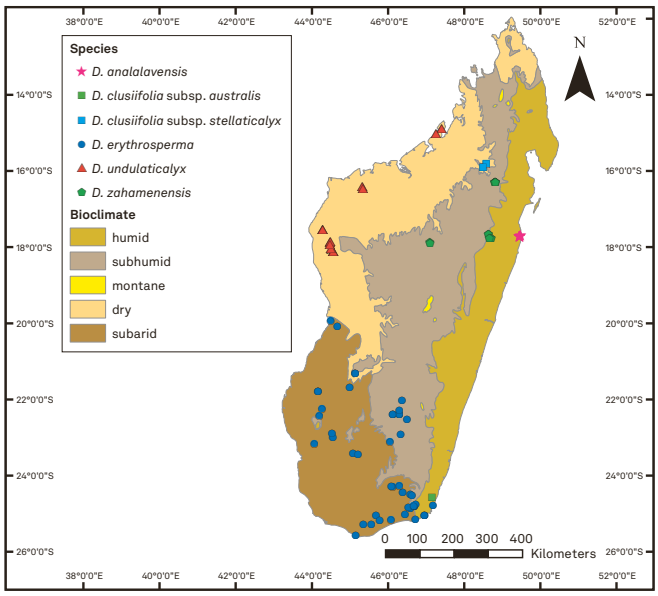

Fig. 3. – Distribution map of *Diospyros analalavensis* Lowry, G.E. Schatz, A.G. Linan & H.N. Rakouth, *D. clusiifolia* subpp. *australis* A.G. Linan, H.N. Rakouth & Lowry, *D. clusiifolia* subpp. *stellaticalyx* A.G. Linan, H.N. Rakouth & Lowry, *D. erythrosperma* H. Perrier, *D. undulaticalyx* A.G. Linan, H.N. Rakouth, G.E. Schatz & Lowry, and *D. zahamenensis* Lowry, G.E. Schatz, A.G. Linan & H.N. Rakouth.

"Near Threatened" [NT], as the number of locations exceeds the upper limit for "Vulnerable" status under criterion B2.

Notes. – Within the Tetraclis group, *Diospyros crassipedicellata* can be distinguished by its distinctively thickened pedicel in fruit, which is (5–)6.5–8.5 mm in diam. (see Schatz et al., 2021b, fig. 8). It is a large tree species and therefore a potential source of ebony (Lowry et al., 2024), so precise locality information has been withheld.

Additional specimens examined. – Madagascar. **Reg. Analanjirofo [Prov. Toamasina]:** Ambanizana, 20.IX.2002, fr., *Antilahimena 1421* (MO, P, TAN); ibid., 9.XI.1994, fr., *Rabe 195* (MO, P, TAN); ibid., 27.VI.1994, fr., *Randriamarosoa et al. 172* (MO, P, TAN); Farankaraina, 27.VIII.1954, fr., *Service Forestier 10738* (MO, P, TEF); ibid., 16.IX.1957, fr., *Service Forestier 18318* (G, MO, P, TEF); Île Sainte-Marie, 18.V.1969, fr., *Service Forestier 28842* (MO, P, TEF). **Reg. Atsinanana [Prov. Toamasina]:** Mahavelona, Foulpointe, 7.X.2011, fr., *Andriamiarinoro & Amosa 247* (MO, P, TAN); Maroseranana, 24.III.2011, ♂ fl., *Antilahimena 7783* (MO, P, TAN); Analalava Reserve, 13.IX.2017, fr., *Grevais 120* (MO, P, TAN); ibid., 15.I.2017, bud, *Lowry et al. 7520* (MO, P, TAN); ibid., 18.VI.2012, y.fr., *Miandrimanana et al. 556* (MO, P, TAN); Ambalabe, Sahanionaka, 7.II.2011, ♂ fl., *A. Randrianasolo et al. 1385* (MO, P, TAN); Ankerana, 18°25'49"S 48°47'14"E, 900 m, 14.III.2011, fl., *Ravelonarivo & Edmond 3666* (MO, P, TAN); Analalava Reserve, 8.V.2017, fr., *Razakamalala 8075* (MO, P, TAN). **Reg. Atsimo-Atsinanana [Prov. Fianarantsoa]:** Manombo, 27.VII.1955, fr., *Service Forestier 13956* (P); ibid., 10.I.1955, ♂ fl., *Service Forestier 12940* (G, MO, P, TEF).

8. ***Diospyros erythrosperma*** H. Perrier in Mém. Inst. Sci. Madag., Sér. B, Biol. Vég. 4: 125. 1952 (Fig. 6A).

Lectotypus (designated by Schatz & Lowry, 2011: 274): **Madagascar. Reg. Ihorombe [Prov. Finarantsoa]:** bords rocailleux (gneiss et grès) de l'Imaloto (bassin de l'Onilahy), VII.1910, fr., *Perrier de la Bâthie 8807* (P [P00573507]!; isolecto-: P [P00573508]!).

= *Diospyros vescoi* var. *mandrarensis* H. Perrier in Mém. Inst. Sci. Madag., Sér. B, Biol. Vég. 4: 147. 1952. **Lectotypus** (designated by Schatz & Lowry, 2011: 274): **Madagascar. Reg. Anosy [Prov. Toliara]:** vallée de la Manambolo, rive droite (bassin du Mandrare), Mont Morahariva (Mahamena), XII.1933, fr., *Humbert 13208* (P [P00573677]!; isolecto-: P [P00573676]!).

Small tree 2–10(–15) m tall, 5–25 cm DBH. *Stem* shoot apex without numerous cataphylls prior to extension, young stems densely covered with straight, semi-appressed to erect golden trichomes < 0.5 mm long, mature stems gray to light gray. *Leaves* alternate, lamina 2.5–7.8 × 0.8–4.3 cm, obovate to elliptic, subcoriaceous, densely covered with straight, semi-appressed whitish trichomes < 0.5 mm long on both surfaces, nearly glabrescent on adaxial surface only, base cuneate to rarely attenuate, margin slightly revolute and ciliate, apex rounded to obtuse, rarely emarginate, lacking a mucro, midvein flat to slightly impressed on adaxial surface, raised on abaxial surface, venation weakly brochidodromous, secondary veins 6–11 per side, slightly raised and indistinct on both surfaces; petiole (3–)5–11 mm long, 1–1.5 mm in diam., densely covered with straight semi-appressed whitish to golden trichomes < 0.5 mm long, glabrescent. *Male flowers* borne in axillary, 3–4-flowered umbellate inflorescences, the main axis (peduncle) 5–10 mm long, 0.5–1.0 mm in diam., densely covered with erect, straight, golden trichomes < 0.5 mm long, pedicel c. 1.0–1.5 mm long, c. 1 mm in diam., densely covered with erect, straight, golden trichomes < 0.5 mm long; calyx cupuliform, c. 5 × 6–7 mm, densely covered with semi-appressed, straight, golden trichomes < 0.5 mm long, the 4 lobes triangular, 1.5–2 × 1.5–2 mm; corolla cupuliform, 6–7 mm long, densely covered outside with appressed, whitish trichomes < 0.5 mm long, glabrous inside, the 4 lobes valvate, rounded-triangular to rounded, c. 2.5 × 3 mm; stamens 14–34, inserted in a single whorl on the corolla c. 1 mm above the base, subsessile, anthers 2–2.5 mm long, narrowly ovoid to ellipsoid, apically dehiscent; pistillode broadly ovoid, c. 1 × 1–1.5 mm, densely covered with straight, erect, white trichomes c. 0.25 mm long. *Female flowers* not seen. *Fruits* axillary, solitary, pedicel in fruit 2–6 mm long, 2–3 mm in diam., densely covered with straight semi-appressed golden trichomes < 0.5 mm long, distal abscission zone 3.8–4.9 mm in diam., glabrescent; fruiting calyx accrescent, shallowly cupuliform, densely covered with persistent, straight, appressed to

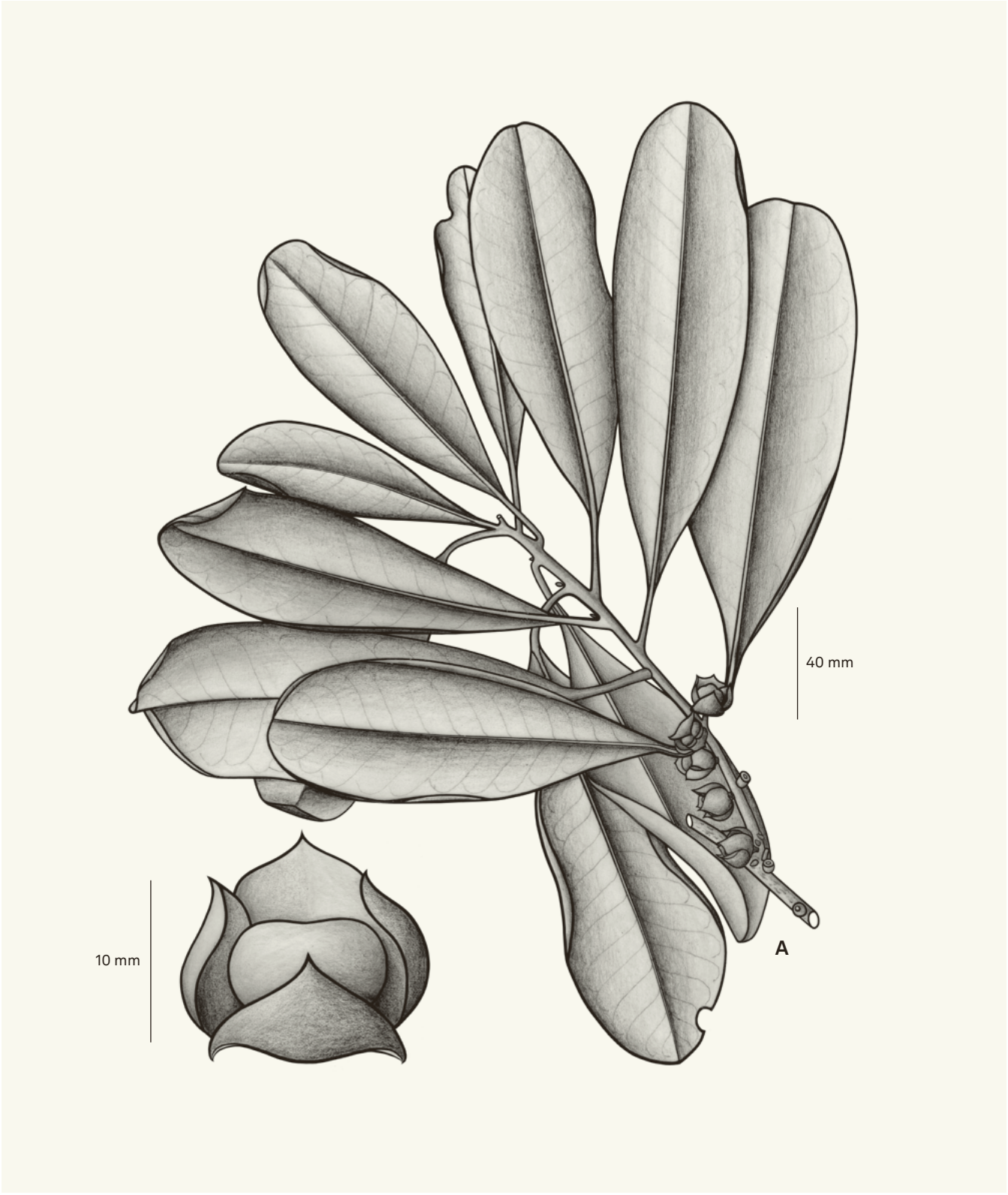

Fig. 4. – *Diospyros clusiifolia* subsp. *australis* A.G. Linan, H.N. Rakouth & Lowry. **A.** Branch with young fruits; **B.** Schematic drawing of fruit and fruiting calyx.
[**A, B:** *Randriatafika 928*, P] [Drawing: Alain Jouy]

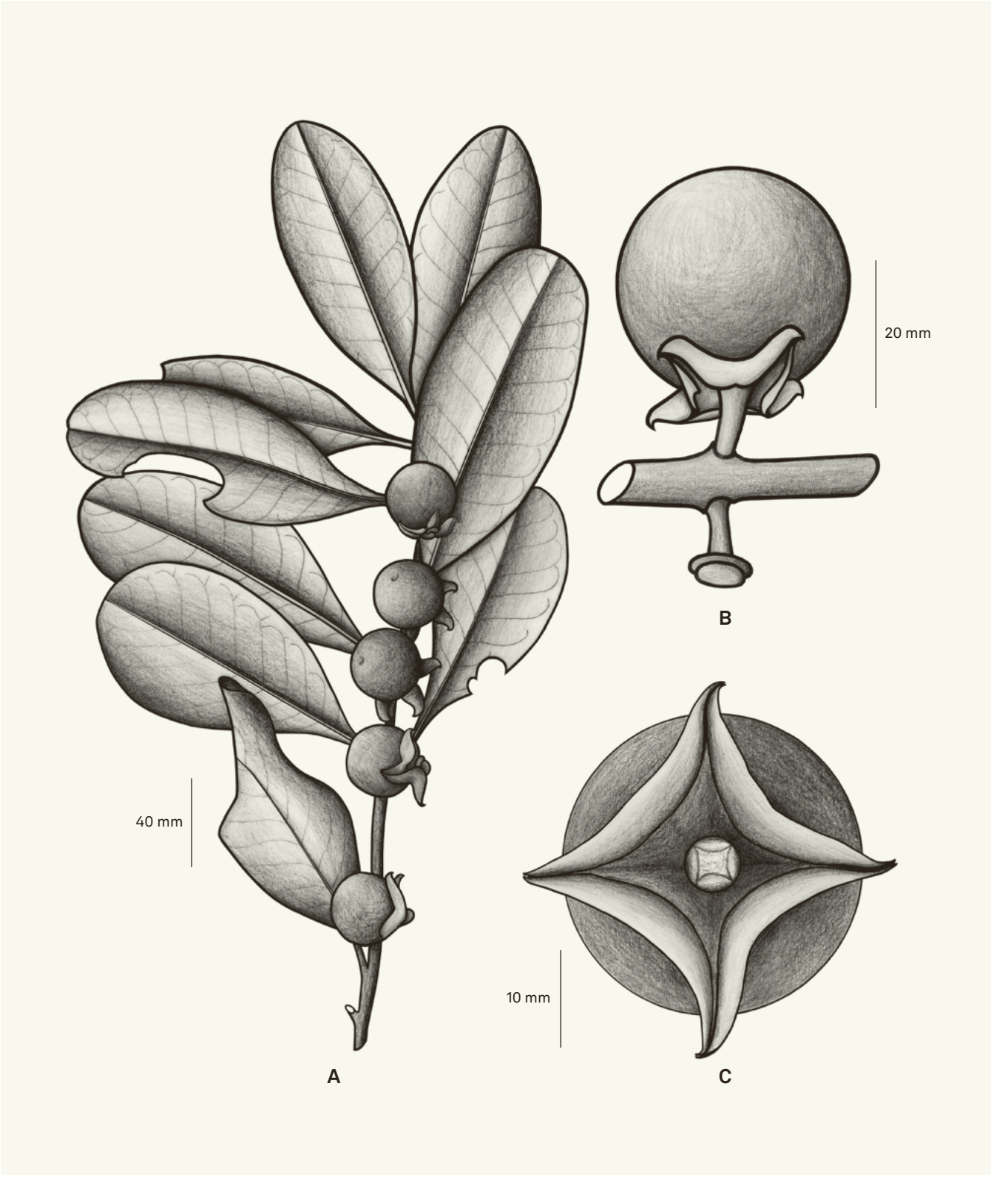

Fig. 5.– *Diospyros clusiifolia* subsp. *stellaticalyx* A.G. Linan, H.N. Rakouth & Lowry. **A.** Branch with fruits; **B.** Detail of Fruit attached to pedicel; **C.** Fruiting calyx.
[**A–C:** *Lehavana et al. 174*, P] [Drawing: Alain Jouy]

semi-appressed, whitish trichomes < 0.5 mm long, the united portion 4–5 × 14–15 mm, the lobes 4, rounded-triangular, 3–4 × 11–13 mm, spreading, not appressed to the fruit surface, margins slightly thickened to very slightly reflexed along their entire length, apex acute, occasionally somewhat reflexed; fruit 4-locular, spherical, 20–24 × 20–25 mm, the apex round, with a stylar remnant, surface slightly verrucose, densely covered with straight, appressed to semi-appressed, whitish trichomes < 0.5 mm long, somewhat glabrescent. *Seeds* not seen.

Vernacular names and uses. – "Lopingo" (*Du Puy MB565*), "Mapingo" (*Ramison 456, Randiatsivery 255, Razakalala 5183*), "Mentifo" (*Réserves Naturelles 10077*), "Pingo" (*SNGF 2608, Randrianaivo 3391*), "Relezo" (*Humbert 11658*), "Satraha" (*Service Forestier 7745*), "Tapianalika" (*Service Forestier 22565*), "Tsitake" (*Perrier de la Bâthie 8807*).

A source of hardwood used in house posts (*Service Forestier 7745*).

Distribution and ecology. – *Diospyros erythrosperma* occurs in southern Madagascar, from Cap Sainte Marie to as far north as Kirindy forest in the Menabe region (Fig. 3). It is found on sandy soils in low elevation littoral forest and mid-elevation dry forests up to 1200 m.

Phenology. – Flowering material has been collected from January to April and from October to December; fruiting collections have been recorded throughout most of the year.

Conservation status. – The risk of extinction of *Diospyros erythrosperma* was recently assessed as "Least Concern" [LC] by Faranirina et al. (2019a) and no update is required.

Notes. – As indicated by Perrier de la Bâthie (1952a, b), the seeds of *Diospyros erythrosperma* are red, as suggested by the species name. This is a large tree species and therefore a potential source of ebony (Lowry et al., 2024), so precise locality information has been withheld.

Additional specimens examined. – Madagascar. **Reg. Amoron'i Mania [Prov. Fianarantsoa]:** N de Zazafotsy, 2.XII.1968, fr., *Service Forestier 28472* (BR, MO, P, TAN). **Reg. Androy [Prov. Toliara]:** Andohahela, au NW d'Imonty, 19.I.2007, fr., *Andriamihajarivo 1179* (DBEV, MO, P, TAN); Ankotsy, 12.XI.2008, fl., *Andriamihajarivo 1568* (CNARP, MO, P, TAN); NAP Vohidava-Betsimalaho, 26.I.2022, fr., *Antilahimena 9992* (G, MO, P); Ambovombe, X.1956, bud, *Bosser 10317* (P); W of Tsiombe, 26.I.1990, fl., *Du Puy MB565* (K, MO, P, TAN, TEF); road to Ambovombe, II.2007, fl., *Groeninckx 232* (P); Mont Vohipolaka, XI.1933, fl., *Humbert 11658* (MO, P, TEF); environs d'Isomonony, XII.1933, fr., *Humbert 12904* (P); près de Mahamavo, I.1934, fl., *Humbert 13870* (P, TAN); SW de Fort-Dauphin, 21.II.1955, bud, *Humbert 29039* (MO, P, TAN); Andohahela, 16.IV.1996, fl., fr., *Laha 72* (P); Ehoala, 27.IV.2015, fr., *Rafanomezantsoa 1* (MO, TAN); Andohahela, III.1994, fl., *Rakotomalaza 187* (P); Ehoala, 24.XI.2007, ster., *Ramison 456* (CNARP, MO, P, TAN); Sainte Luce, 8.I.2008, fl., *Ramison 516* (CNARP, MO, P, TAN); Ankoba, 22.II.2009, bud, *Randrianaivo 1738* (CNARP, MO, P, TAN); Anadabolava, 25.X.2007, fr., *Randriatsivery 255* (P); Ankoba, 17.XI.2009, fr., *Ratovoson 1509* (CNARP, MO, P, TAN); Amboasary, 10.X.1956, fl., *Réserves Naturelles 8185* (P, TEF); Behara, 22.XI.1958, fl., *Réserves Naturelles 10077* (P, TEF); Antanimora-Ambovombe, 12.VIII.1953, fr., *Service Forestier 7745* (MO, P, TAN); Cap Ste Marie, 27.I.1963, bud, *Service Forestier (Capuron) 22565* (P, TEF); Ambovombe, 15.I.1955, ster., *Service Forestier de Madagascar 57-R-189* (P). **Reg. Atsimo-Andrefana [Prov. Toliara]:** Miary, 27.IX.2007, fr., *Rakotoarisoa 558* (MO, P, TAN); Beronono-Makay, 17.I.2010, fr., *Rakotovao 5121* (G, MO, P, TAN, TEF); ibid., 17.I.2010, fr., *Razakamalala 5183* (P); Ambalamanga, 21.I.2011, fl., *Razakamalala 6121* (MO, TAN); Sakaraha, 22.I.1951, fr., *Service Forestier 2812* (P); Lamboniakondro, 21.VIII.1953, fr., *Service Forestier 8297* (MO, P, TAN); forêt d'Ihera, 10.IV.1954, fr., *Service Forestier 9796* (MO, P, TAN); Sakaraha, 25.IV.1955, fr., *Service Forestier 13377* (MO, P); forêt d'Herea, 16.XII.1962, fl., *Service Forestier (Capuron) 22219* (P, TEF); Ambalamanga, 17.X.2010, fr., *SNGF 2608* (P). **Reg. Ihorombe [Prov. Fianarantsoa]:** Ihosy, 28.I.1955, fl., *Humbert 28620* (MO, P, TAN); près d'Ihosy, III.1912, fr., *Perrier de la Bâthie 8751* (P); ibid., IX.1911, fr., *Perrier de la Bâthie 8769* (MO, P); ibid., 21.III.1952, fr., *Service Forestier 4620* (MO, P, TAN); ibid., 30.X.1953, bud, *Service Forestier 7624* (MO, P, TAN); forêt de Kitranga, 24.I.1955, fr., *Service Forestier (Capuron) 11610* (MO, P, TAN); Ihosy, 16.IX.1968, fr., *Service Forestier (Capuron) 28273* (MO, P, TAN). **Reg. Menabe [Prov. Toliara]:** Vondrove, 17.X.2010, fr., *Rakotoarisoa 2608* (K, MO, P, TAN, TEF); concession forestière du CFPF, 19.VII.1994, fr., *Randriamarosoa 182* (P, WAG); Kirindy, 13.IV.2019, ster., *Randrianaivo 3391* (P).

9. ***Diospyros farankarainensis*** A.G. Linan, H.N. Rakouth & Lowry, **sp. nov.** (Fig. 6B, 7).

Holotypus: Madagascar. **Reg. Analanjirofo [Prov. Toamasina]:** env. de la Baie d'Antongil, massif Farankaraina, entre Navana et Andranofotsy, [15°25'00"S 49°52'00"E], 0–150 m, 18.IX.1957, fr., *Service Forestier 18330* (P [P03829428]!; iso-: G!, MO-6813112!, P [P00722728]!, TEF).

Diospyros farankarainensis A.G. Linan, H.N. Rakouth & Lowry can be distinguished from the species it most closely resembles vegetatively, D. mucronata Lowry, G.E. Schatz, A.G. Linan & H.N. Rakouth and D. rakotovaoi G.E. Schatz & Lowry, by its leaves with acuminate apices (vs. rounded or acute in the two other species) as well as the lobes of its fruiting calyx, which extend 3–6 mm below the sinuses onto the calyx cup (vs. margins extending no more than 1 mm below the sinuses).

Small tree, 2.5–10 m tall, 7–9 cm DBH. *Stem* shoot apex without numerous cataphylls prior to extension, young stems sparsely covered with straight, appressed to semi-erect, light brown trichomes 0.5–1 mm long, mature stems reddish-brown, glaucescent. *Leaves* alternate, lamina 6.8–14.5 × 2.3–4.6(–6) cm, obovate-elliptic, subcoriaceous, sparsely covered with, straight, appressed, golden trichomes 0.5–1 mm long on both surfaces, glabrescent, base cuneate, margin slightly revolute, often ciliate, apex acuminate, with distinct mucro 2–3 mm long, very rarely rounded-obtuse, midvein slightly impressed on adaxial surface, raised on abaxial surface, venation weakly brochidodromous, secondary veins 9–14 per side, slightly raised on adaxial surface, raised on abaxial surface; petiole

4–8(–12) mm long, 1.5–2 mm in diam., sparsely covered with straight, appressed, whitish trichomes 0.5–1 mm long, glabrescent. *Male flowers* (known from only immature material) borne in axillary, c. 3–7-flowered cymose inflorescences, the main axis (peduncle) 20–15 mm long, 1.5 mm in diam., densely covered with erect, straight, rusty trichomes c. < 0.5 mm long, pedicel 5–7 mm long, 1–1.5 mm in diam., densely covered with rusty trichomes c. 0.5 mm long; calyx cupuliform, densely covered with semi-appressed, straight, golden trichomes 0.25–0.5 mm long, united portion c. 3–4 mm long, 6–7 mm in diam., calyx lobes 4, triangular, 3.5–4 × 4–5 mm; corolla fleshy, cupuliform, densely covered outside and inside with straight, appressed, golden trichomes c. 0.5 mm long, corolla tube 4.5–5 mm long, the 4 lobes valvate, rounded triangular, c. 3 × 3 mm; stamens c. 14–16, subsessile, inserted in a single whorl on the corolla c. 2.5–3 mm above the base, anthers 3–4 mm long, apically dehiscent; pistillode discoid, c. 0.5 × 2.5–3 mm, densely covered with straight, erect, golden trichomes c. 1 mm long. *Female flowers* not seen. *Fruits* axillary, solitary, pedicel in fruit 3–4 mm long, 2–3 mm in diam., densely covered with same indument as petiole, distal abscission zone 5–7 mm in diam.; fruiting calyx accrescent, cupuliform, densely covered with same indument as pedicel, persistent, the united portion 12–19 × 30 mm, the lobes 4 or 5, rounded-triangular, 16–20 × 22–25 mm, spreading slightly, such that the apex is not appressed to the fruit surface, margins flat becoming reflexed toward the base and extending 3–6 mm below the sinuses onto the calyx cup, apex acute; fruit 4-locular, spherical to ovoid, 30–40 × 30–31 mm, the apex rounded to widely obtuse, surface smooth, densely covered with same persistent indument as pedicels. *Seeds* spherical wedge-shaped (i.e. like the segment of an orange), 20–22 × 9–10 mm.

Etymology. – The name chosen for this species reflects the fact that it is only known to occur at the Farankaraina forest located c. 6 km to the E of Maroantsetra and on the island of Nosy Mangabe, situated about the same distance to the WSW in the Baie d'Antongil.

Distribution and ecology. – *Diospyros farankarainensis* is restricted to the Farankaraina Forestry Station and Nosy Mangabe near Maroantsetra in northeastern Madagascar (Fig. 8). It is found in low elevation humid up to 70 m elevation.

Phenology. – Flowering material has been collected in January and December; fruiting collections have been recorded in September.

Conservation status. – *Diospyros farankarainensis* has a geographic range in the form of an EOO of 0.4 km² and a minimum AOO of 12 km². However, according to the IUCN guidelines (IUCN, 2024), the EOO cannot be smaller than the AOO, so both parameters have a value of 12 km², which falls within the limits for "Critically Endangered" status under the criterion B1 and "Endangered" status under criterion B2. It is present at a single protected area, Réserve Speciale Nosy Mangabe, and at the unprotected Farankaraina forestry station, where it is threatened by forest clearing for slash and burn agriculture, vanilla cultivation, fire, logging, and wood harvesting for tree species, which are projected to result in continuing decline in quality of habitat and number of mature individuals. With respect to the most serious plausible threat of forest clearing for agriculture, it exists at two locations. Therefore, *D. farankarainensis* is provisionally assessed as "Endangered" [EN B1ab(iii,v)+ B2ab(iii,v)].

Notes. – *Diospyros farankarainensis* has a distinctive fruiting calyx in which the lobes extend well below the sinuses onto the calyx cup containing the fruit (Fig. 6B). It has been collected recently in flower at both Farankaraina and Nosy Mangabe, although the only known collection in fruit was made nearly 70 years ago.

Additional specimens examined. – **Madagascar. Reg. Analajirofo [Prov. Toamasina]:** Andranofotsy, forêt de Farankaraina, 15°26'05"S 49°50'14"E, 68 m, 16.XII.2018, fl., *Bernard 2638* (DBEV, MO, P); RS Nosy Mangabe, plage des Hollandais, 15°28'49"S 49°46'00"E, 10 m, 20.I.2006, fl., *Raharimampionona et al. 122* (G, MO, NY, P, TEF); Andranofotsy, forêt de Farankaraina, 15°25'53"S 49°50'35"E, 32 m, 15.XII.2018, fl., *Razakamalala 8262* (DBEV, G, MO, P, TAN).

10. ***Diospyros fuscovelutina*** Baker in J. Linn. Soc., Bot. 21: 422. 1885 (Fig. 6C).

Lectotypus (designated by Schatz & Lowry, 2011: 275): **Madagascar:** sine loco, 1870–1907, fr., *Baron 2361* (K [K000350799]!; isolecto-: K [K000350798]!, P [P00541752]!).

Tree 2–13 m tall, 2.5–20 cm DBH. *Stem* shoot apex without numerous cataphylls prior to extension, young stems sparsely covered with straight erect to semi-appressed light brown trichomes < 0.5 mm long, mature stems dark gray to dark brown, occasionally glaucescent, rarely lenticellate. *Leaves* alternate, lamina 12–20(–37) × 3.5–9.5 cm, oblong to elliptic, rarely narrowly elliptic, coriaceous (young leaves not seen), nearly glabrous on both surfaces but with sparse, erect, blonde trichomes < 0.5 mm long along the abaxial midrib, base cuneate to obtuse, margin slightly revolute and often ciliate, apex rounded to rounded-acute, lacking a mucro, midvein impressed on adaxial surface, raised on abaxial surface, venation weakly brochidodromous, secondary veins 12–15 per side, raised on both surfaces; petiole 15–20 mm long, 2.5–3 mm in diam., nearly glabrous, with sparse erect, blonde trichomes 0.5–1 mm long. *Male flowers* borne in axillary, c. 20–40-flowered cymose inflorescences, the main axis (peduncle) 30–45 mm long,

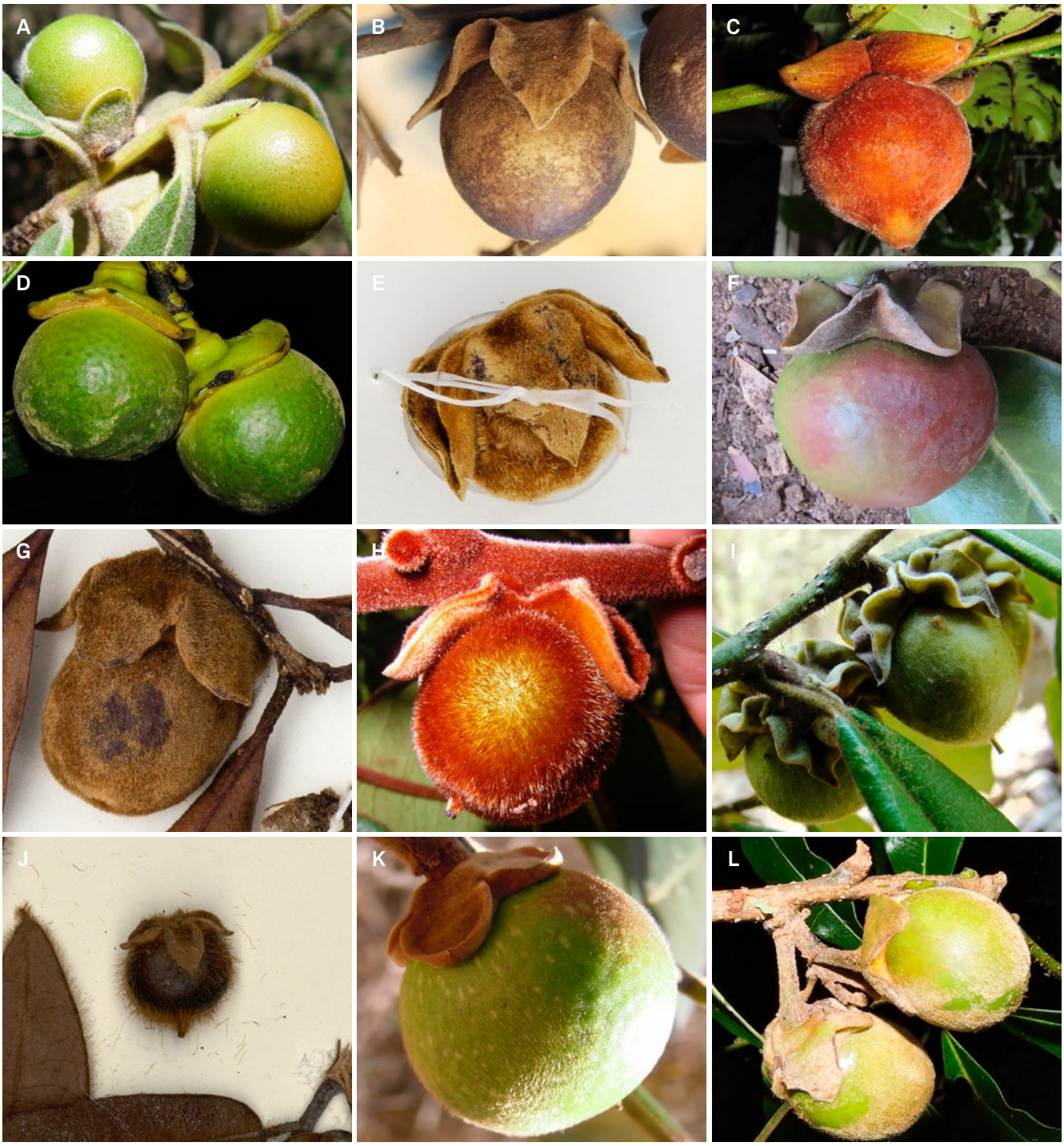

Fig. 6. – Photographs of fruits of *Diospyros* L. species. **A.** *Diospyros erythrosperma* H. Perrier; **B.** *Diospyros farankarainensis* A.G. Linan, H.N. Rakouth & Lowry; **C.** *Diospyros fuscovelutina* Baker; **D.** *Diospyros mimusops* G.E. Schatz & Lowry; **E.** *Diospyros mucronata* Lowry, G.E Schatz, A.G. Linan & H.N. Rakouth; **F.** *Diospyros parifolia* H. Perrier; **G.** *Diospyros rakotovaoi* G.E. Schatz & Lowry; **H:** *Diospyros sambiranensis* A.G. Linan, H.N. Rakouth & Lowry; **I.** *Diospyros undulaticalyx* A.G. Linan, H.N. Rakouth & Lowry; **J.** *Diospyros urschii* H. Perrier; **K.** *Diospyros vescoi* Hiern; **L.** *Diospyros zahamenensis* Lowry, G.E. Schatz, A.G. Linan & H.N. Rakouth. [**A:** *Ratovoson 1509*; **B:** *Service Forestier 18330*; **C:** *Andriamiarisoa 2436*; **D:** *Razakamalala 8563*; **E:** *Rakotovao 3202*; **F:** *Razakamalala 8136*; **G:** *McPherson 17114*; **H:** *Razafitsalama 1069*; **I:** *Andriamihajarivo 1772*; **J:** *Andrianantoanina 1008*; **K:** *Ludovic 1420*; **L:** *Andrianarivelo 87*] [Photos: **A:** F. Ratovoson; **B, E, G, J:** A.G. Linan; **C:** R.L. Andriamiarisoa; **D, L:** S.A.F. Andrianarivelo; **F:** R. Razakamalala; **H:** J.L. Razafitsalama; **I:** R. Letsara; **K:** R. Ludovic]

1.5–2 mm in diam., densely covered with erect, straight, golden trichomes < 0.5 mm long, pedicel 5–7(–15) mm long, c. 1 mm in diam., densely covered with erect, straight, golden trichomes < 0.5 mm long; calyx cupuliform, densely covered with appressed, straight, golden trichomes 0.2–0.3 mm long, united portion c. 5 mm long, 6–7 mm in diam., the lobes 4 triangular, 3.5–4 × 4.5–5 mm; corolla fleshy, cupuliform, densely covered outside and inside with straight, appressed, golden trichomes c. 0.5 mm long, corolla tube 7–8 mm long, the 4 lobes valvate, rounded-triangular, c. 3 × 4–4.5 mm; stamens c. 28–32, c. 5 mm long, attached to the corolla at two levels, 3–4.5 mm above the base and 2–3 mm higher, filaments 1.5–2 mm long, anthers 3–3.5 mm long, apically dehiscent; pistillode broadly ovoid, c. 0.5 × 1.5–2 mm, densely covered with straight, erect, whitish trichomes c. 1.5 mm long. *Female flowers* (known only from immature material) solitary, axillary, sessile to subsessile; calyx cupuliform, densely covered outside and inside with appressed to semi-appressed, chocolate brown trichomes c. 0.2–0.3 mm long, united portion 3–4 × 10–12 mm, the 5(–6?) lobes triangular, 6–8 × 5 mm, apex acute; corolla ovoid, densely covered outside and inside with appressed, light brown trichomes c. 0.5 mm long, becoming glabrous inside toward the base, corolla tube 10 mm long, 9–10 mm in diam., the 5 lobes valvate, triangular, 2–3 × 2 mm, staminodia absent; ovary broadly ovoid, c. 7–8 × 7 mm, densely covered with erect, stiff, chocolate brown trichomes c. 1.5 mm long, styles not seen. *Fruits* axillary, solitary, pedicel in fruit 8–9 mm long, 3–4 mm in diam., densely covered with straight, erect light brown trichomes 0.5–1 mm long, distal abscission zone 4.8–5.8 mm in diam.; fruiting calyx accrescent, shallowly cupuliform, densely covered with same indument as pedicel, persistent, the united portion 10–15 × 20–25 mm, the lobes 4 or 5, triangular to rounded-triangular, 15–20 × 15–20 mm, spreading, not appressed to the fruit surface, margins flat throughout, apex acute, often reflexed, adaxial surface usually with longitudinal wrinkles or striations; fruit 4-locular, spheroid, 30–40 × 30–40 mm, the apex rounded or rostrate, rostrum up to c. 8 mm long, surface smooth, densely covered with persistent, straight, erect, light brown trichomes 1.5–2 mm long. *Seeds* spherical wedge-shaped (i.e. like the segment of an orange), 20 ×14 mm.

Vernacular names and uses. – "Hazomafana" (*Antilahimena 9674*, *Bernard 2461*, *Birkinshaw 1460, Dumetz 1028*, *Gervais 86*, *91*, *Lehavana 589*, *683*, *1203*, *Ratovoson 2084*), "Hazomainty" (*Miandrimanana 6*, *551*, *Rajaonary 52*, *230*, *Syde 17*, *462*), "Jôbiampototra" (*Martial 71*, *292*, *388*, *784*, *823*, *824*, *Rakotonirina 690*).

Used for housing construction (*Martial 292*, *388*, *784*, *824*).

Distribution and ecology. – *Diospyros fuscovelutina* is distributed along the eastern coastline of Madagascar from as far south as Ranomafana Est (Atsinanana region) to Fanihina forest in the north (SAVA region). It can be found growing on sandy and laterite soils in low-elevation humid and littoral forests from 0 to 450 m elevation and rarely up to 750 m.

Phenology. – Flowering material has been collected from January to May; fruiting collections have been recorded throughout most of the year.

Conservation status. – *Diospyros fuscovelutina* has a geographic range in the form of an EOO of 32,565 km² (exceeding the upper threshold for "Vulnerable" status under the criterion B1) and a minimum AOO of 176 km² (falling within the limits for "Endangered" status under the criterion B2). It is present at 10 protected areas, Analalava, Betampona, Corridor Ankeniheny-Zahamena (Ankerana), Makirovana-Tsihomanaomby, Mananara Nord, Marojejy, Masoala, Pointe à Larrée, Sahafina, and Tampolo. In addition to these legally protected sites, the species has also been recorded from unprotected areas subjected to slash and burn agriculture, wildfires, and exploitation for firewood and house construction material. With respect to the most serious plausible threat of forest clearing for agriculture, *D. fuscovelutina* exists at 20–24 locations, far exceeding the threshold for "Threatened" status under criterion B. Thus, based on new occurrences recorded since the recent publication its risk of extinction on the IUCN Red List as "Vulnerable" (Faranirina et al., 2019b), the assessment of this species is updated to "Least Concern" [LC].

Notes. – *Diospyros fuscovelutina* is another one of the five species in the Tetraclis group with leaves that often exceed 20 cm in length (see note above under *D. ambanjensis*). In their nomenclatural review of Malagasy ebonies, Schatz & Lowry (2011) circumscribed this species to include material previously placed in *Tetraclis baronii* by Hiern (1873) and Perrier de la Bâthie (1952a, b), but Rakouth et al. (2023) recently showed that they represent distinct taxa, establishing a new combination for *D. baronii* and restricting *D. fuscovelutina* to material with ovate to elliptic leaves and a fruiting calyx whose lobes have distinct longitudinal wrinkles or striations on the adaxial surface and thickened margins, and that are not appressed to the fruit surface. *Diospyros fuscovelutina* is a large tree species and therefore a potential source of ebony (Lowry et al., 2024), so precise locality information has been withheld.

Additional specimens examined. – **Madagascar. Reg. Analajirofo [Prov. Toamasina]:** Ambanizana, 13.II.2016, fl., *Bernard 2461* (MO, G, P, TAN, TEF); Ambohitsara, 12.IV.2019, bud, *Bernard 2731* (DBEV, MO, P, TAN); Ivontaka-Sud, 22.XI.1989, fr., *Dumetz 1028* (MO); forêt d'Antsiaradava, 17.X.2019, fr., *Lehavana 1203* (MO, P, TAN); Tampolo, 8.II.2007, fr., *Miandrimanana 6* (MO, P, TAN); près d'Antanambe, 2.XII.1989, fr., *Morat 8578* (P); Manambato forest, 26.II.1987, fr., *Nicoll 444* (MO); Fénérive, IX.2012, fr., *Perrier de la Bâthie 8760* (MO, P, TAN); Ambanizana, 17.III.1995, fr., *Rahajasoa 1151* (MO, P, TAN); forêt Ibanda, 12.II.1990, fr.,

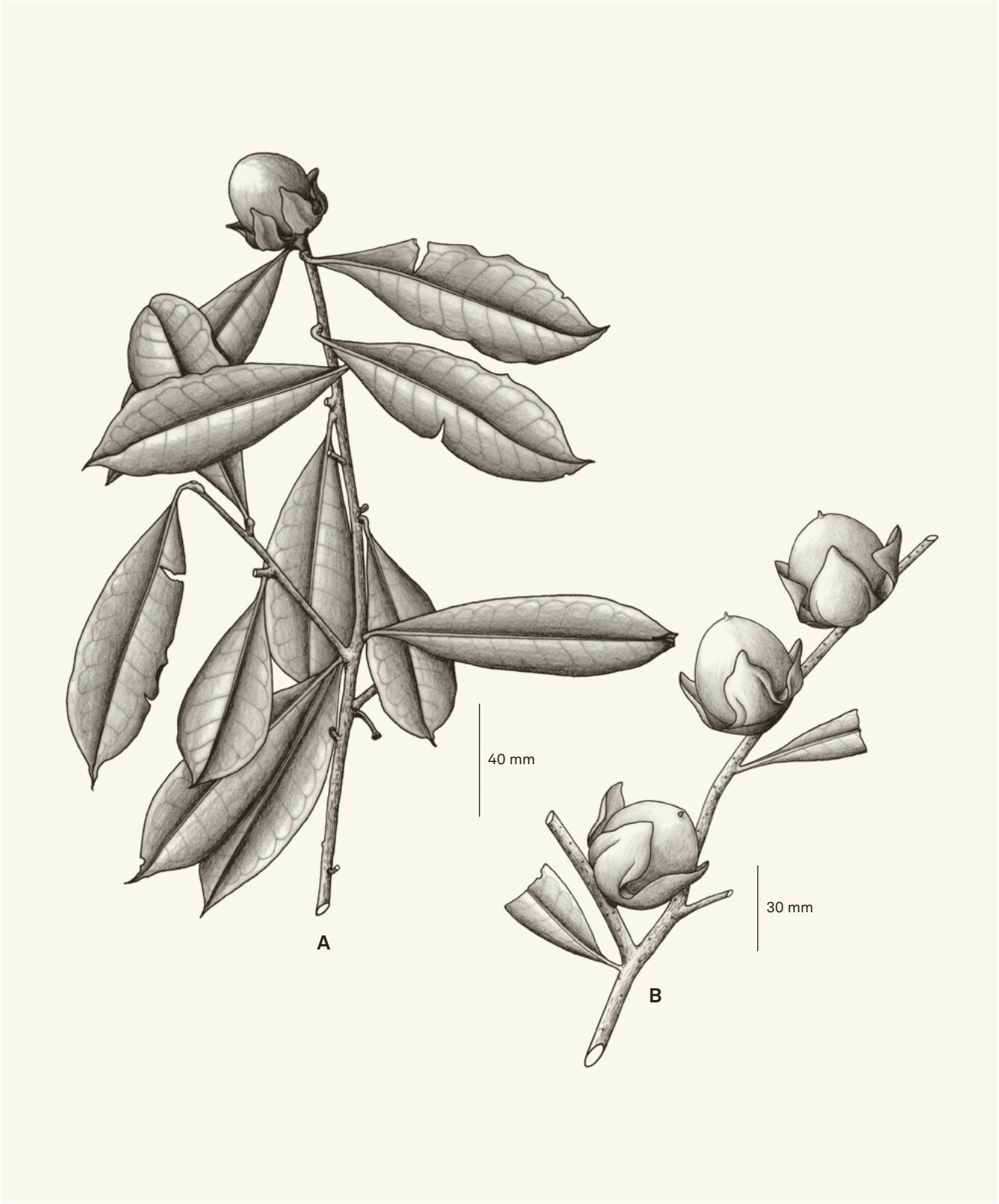

Fig. 7. – *Diospyros farankarainensis* A.G. Linan, H.N. Rakouth & Lowry. **A.** Branch with fruit; **B.** Fruits. [**A, B:** *Service Forestier 18330*, P] [Drawing: Alain Jouy]

Raharimalala 270 (P, TEF); Andranomalany, 13.IX.2019, fr., *Rajaonary 230* (MO, P, TAN); Ambohimarina, 1.VIII.2015, fr., *Rakotonasolo 2626* (K, P, TAN); Pointe à Larée AP, 13.III.2020, fr., *Rakotovao 7645* (DBEV, MO, P, TAN); Analalava, 27.I.2014, ster., *Razakamalala 7718* (BR, G, MO, P); Pointe à Larée AP, 13.IV.2019, fr., *Razakamalala 8361* (DBEV, MO, P, TAN); W of Maroantsetra, 28.XI.1987, fr., *Schatz 1793* (MO, P, WAG); forêt de Sahavolamena, 16.XI.1964, fr., *Service Forestier (Capuron) 23811* (MO, P); colline de Menatany, 20.XII.1967, fr., *Service Forestier (Capuron) 28103* (P); Andranomody, 20.III.2019, fr., *Syde 462* (MO, P, TAN); ibid., bud, *Syde 464* (MO, P, TAN); road to Sonierana-Ivongo, 14.I.2006, fr., *Tosh 118* (BR, MO, P, TAN). **Reg. Atsinanana [Prov. Toamasina]:** Andranomangatsiaka, 25.II.2006, fr., *Andriambololonera 135* (TAN); Analalava, 16.XI.2007, fr., *Andriamiarinoro 96* (MO, P, TAN); ibid., 16.IV.2010, fr., *Andrianaivoravelona 277* (K, MO, P, TAN); ibid., 30.X.2000, fr., *Andrianjafy 135* (MO, P, TAN, TEF); Ankerana, 16.XI.2020, fr., *Antilahimena 9674* (MO, TAN); Analalava, 2.V.2010, fr., *Aubriot 90* (P, TAN); ibid., 2.V.2010, bud, *Aubriot 95* (MO, P); ibid., 20.III.2005, fl., *Birkinshaw 1460* (MO, P, TAN); ibid., 23.I.2014, fr., *Birkinshaw 1986* (MO, P, TAN); ibid., 20.X.2015, fr., *Gervais 86* (MO, P, TAN); ibid., 22.IV.2016, fr., *Gervais 91* (MO, TAN); Sahasina, 12.X.2019, fr., *Karatra 187, 188* (DBEV, MO, P, TAN); Analalava, 13.III.2005, fl., *Lehavana 328* (MO, P, TAN); ibid., 15.III.2005, fl., *Lehavana 336* (MO, P, TAN); ibid., 30.V.2007, fr., *Lehavana 589* (MO, P, TAN); ibid., 19.V.2010, fr., *Lehavana 683* (MO, P, TAN); Betampona, 28.IX.1993, fr., *Lewis 668* (MO, P, US); Analalava, 26.III.2012, bud, *Miandrimanana 551* (MO, P, TAN); Sahavongo, 12.II.2019, fl., fr., *Rajaonary 52* (MO, P, TAN); Analalava, 16.IV.2010, fl., *Rajaovelona 217* (K, MO, P, TAN); Ranomafana Est, 15.II.2005, fl., *Rakotonasolo 938* (MO, K, TAN); Betampona, 19.II.2005, fl., *Rakotonasolo 959* (MO, K, TAN); Menafotaka, 28.X.2017, fr., *Rakotonirina 237* (G, K, MO, P, TAN); Ambila-Lemaitso, II.1987, *Rakotozafy 2066* (MO, TAN); Ampasimazava, 3.XI.2017, fr., *Ralaijaona 284* (K, MO, TAN); Analalava, 1.II.2019, fl., *Ralainaorina 4* (MO, P, TAN); ibid., 14.I.2007, fr., *Ranarivelo 1197* (CAS, MO); Ampasina, 28.IX.2017, fr., *Rasoanindriana 303* (K, MO, TAN); Analalava, 19.III.2015, fr., *Ratovoson 2081* (MO, TAN); Betampona, 18.I.2014, bud, *Razakamalala 7703* (BR, G, MO, P); Sahafina, 16.IV.2019, ster., *Razakamalala 8367* (DBEV, MO, P, TAN); Betampona, 24.I.1950, fl., *Réserves Naturelles 2362* (P, TAN); ibid., 5.III.1950, fr., *Réserves Naturelles 2442* (P, TAN); ibid., 28.II.1950, fr., *Réserves Naturelles 2611* (P); ibid., 29.X.1951, fr., *Réserves Naturelles 3247* (P); ibid., 5.IV.1989, fl., *Schatz 2691* (MO, P); Sahafina, 9.I.2017, fr., *Schatz 4422* (MO, TAN); Analangavo, 4.V.1950, fr., *Service Forestier 1352* (P); Betampona, 28.V.1953, fr., *Service Forestier 5354* (MO, P); ibid., 6.XI.1953, fr., *Service Forestier 8597* (P); Analalava, 30.X.1963, *Service Forestier 22787* (MO); ibid., 19.XII.1967, fr., *Service Forestier 28089* (P); Antanetilava, 15.XI.2016, fr., *Syde 17* (G, K, MO, P, TAN); Marofelana, 19.VI.2017, fr., *Syde 226* (G, K, MO, P, TAN); Ampasina, 29.IX.2017, fr., *Syde 316* (K, MO, TAN); Analalava, 12.I.2006, bud, *Tosh 88* (BR, MO, TAN). **Reg. DIANA [Prov. Antsiranana]:** Antanandava, 4.V.2010, fr., *Birkinshaw 1764* (MO, TAN). **Reg. SAVA [Prov. Antsiranana]:** Sahafary, 3.XII.2019, fr., *Andriamiarisoa 2436* (DBEV, MO, P, TAN); Makirovana, 14.III.2013, fl., fr., *Martial 71* (G, K, MO, P, TAN); Tsihomanaomby, 20.XI.2013, fr., *Martial 292* (MO, P, TAN); ibid., 21.I.2014, bud, fl., *Martial 388* (MO, P, TAN); Makirovana, 3.X.2019, fr., *Martial 784* (MO, P, TAN); District SAMBAVA, forêt de Farahanitra, 20.X.2019, fr., *Martial 823, 824* (MO, P, TAN); Makirovana, 22.V.2009, ster., *Raharimampionona 231* (P, TAN); ibid., 23.V.2009, fr., *Raharimampionona 274* (P, TAN); ibid., ster., *Raharimampionona 276* (P, TAN); Tsihomanaomby, 13.IV.2021, fr., *Rakotonirina 690* (MO, P, TAN); Andratamarina, 19.X.2010, ster., *Ravelonarivo 3519* (MO, P, TAN); foret d'Anketrabe Kalivery, 15.XI.2021, ster., *Ravelonarivo 5038* (MO, P, TAN); ibid., *Ravelonarivo 5048* (MO, P, TAN); Makirovana, 6.V.2010, fl., *Razakamalala 5493* (MO, TAN); colline de Moratsiazo, 5.IV.1967, ster., *Service Forestier 27681* (TEF).

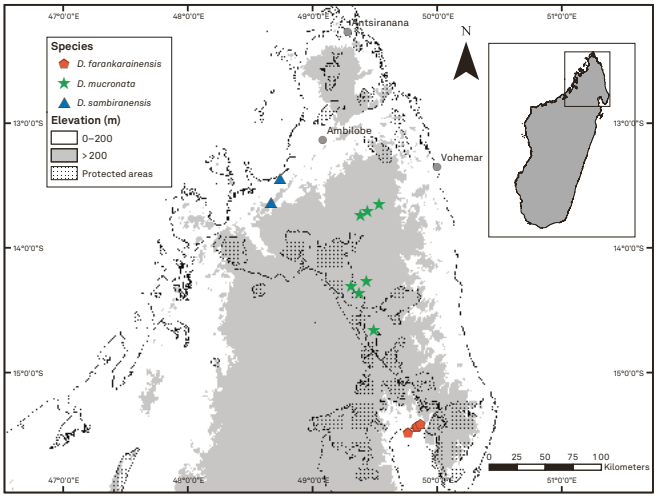

Fig. 8. – Distribution map of *Diospyros farankarainensis* A.G. Linan, H.N. Rakouth & Lowry, *D. mucronata* Lowry, G.E. Schatz, A.G. Linan & H.N. Rakouth, and *D. sambiranensis* A.G. Linan, H.N. Rakouth & Lowry.

11. ***Diospyros mimusops*** G.E. Schatz & Lowry in Candollea 76: 228. 2021 (Fig. 6D).

Holotypus: Madagascar. Reg. Anosy [Prov. Toliara]: Antsotso, 24.V.2006, fr., *Antilahimena et al. 4887* (MO-6336318!; iso-: G [G00341898]!, P [P06490534]!, TAN [TAN002011]!, TEF!, W).

Tree 5–20 m tall, 8–17 cm DBH. *Stem* shoot apex without numerous cataphylls prior to extension. *Leaves* alternate, lamina 6–11.5 × 2.2–4.2 cm, elliptic to obovate, coriaceous, glabrous, sometimes shiny or glaucous on adaxial surface in sicco, base attenuate to acute, margin revolute, apex acute to shortly acuminate, occasionally rounded to retuse, acumen 2–3 mm long, usually with a very short, black mucro, secondary veins 10–15 per side; petiole 12–22 mm long, 1–1.5 mm in diam. *Male flowers* borne in axillary, 3–5-flowered cymose inflorescences, the main axis (peduncle) 10–20 mm long, 0.5–1 mm in diam., sparsely covered with appressed white trichomes c. 0.2 mm long, pedicel 5–13 mm long, 0.5–0.8 mm in diam.; calyx 4-lobed, the lobes broadly triangular, 2.5 × 3.5 mm, apex shortly acuminate, rather sparsely covered outside with appressed white trichomes c. 0.2 mm long, glabrous inside; corolla 4-lobed, the lobes valvate; stamens c. 30, inserted on the corolla at the midpoint, in two series, the lower with slender, terete, sigmoid filaments c. 1.5 mm long, upper with flattened filaments 3.5 mm long, anthers 2.5 mm long, dehiscing by apical pores. *Female flowers* not seen. *Fruits* axillary, solitary, pedicel in fruit 4–5 mm long, 4–5 mm in diam., sparsely covered with appressed white trichomes c. 0.2 mm long, distal abscission zone 5.7–5.9 mm in diam.; fruiting calyx broadly cupuliform, 7 × 18–22 mm, sparsely covered with appressed white trichomes c. 0.2 mm long, glabrescent, with a distinct basal collar c. 2 mm long, 6–7 mm in diam., the lobes (3–)4,

sometimes very shallowly so (lobes nearly indistinct), the lobes broadly triangular, 2–9 × 10–18 mm, spreading, not appressed to the fruit surface, margin flat or revolute, apex obtuse to rounded; fruit oblate to spheroid, 16–28 × 17–32 mm, the apex depressed, crowned with a very short style/stigma remnant, surface verrucose, sparsely covered with appressed white trichomes c. 0.2 mm long.

Distribution and ecology. – *Diospyros mimusops* is restricted to the far southeast of Madagascar, occurring in the Bemangidy forest on the eastern slope of the Vohimena mountains within the Tsitongambarika reserve and near the Col de Maningotry in Parcel 1 of Andohahela National Park (Madagascar Catalogue, 2024). It occurs in low- and mid-elevation humid forest from 30 to 400 m and rarely as high as 550 m.

Phenology. – Flowering material has been collected in December, and collections with fruit have been made in February, April, May, and November.

Conservation status. – *Diospyros mimusops* has a very restricted geographic range in the form of an EOO of 13.37 km² and an AOO of 12 km². Its distribution is wholly contained within the protected areas of Andohahela and Tsitongambarika. Nevertheless, it occurs near the edge of the forest at Iaboakoho and is thus threatened by ongoing exploitation of trees for firewood and house construction material, which are projected to result in continuing decline in quality of habitat and number of mature individuals. With respect to the most serious plausible threat of exploitation of trees for firewood and house construction material, *D. mimusops* exists at two locations. Despite new occurrence records since publication of a recent assessment on the IUCN Red List (Schatz & Lowry, 2021d), the updated assessment presented here for *D. mimusops* remains unchanged as "Endangered" [EN B1ab(iii,v)+2ab(iii,v)].

Notes. – *Diospyros mimusops*, along with *D. beberonnii* and *D. clusiifolia* subsp. *australis* (see above), are the only members of the Tetraclis group found in humid forest in far southeastern Madagascar. It can be distinguished by its glabrous and sometimes glaucous young stems and leaves (see Schatz et al., 2021b, figs. 13B, 16). *Diospyros mimusops* can develop into large trees and is therefore a potential source of ebony (Lowry et al., 2024), so precise locality information has been withheld.

Additional specimens examined. – **Madagascar. Reg. Anosy [Prov. Toliara]:** road towards Ranomafana Sud, 5.XII.1989, ♂ fl., *McPherson 14621* (G, MO, P, TAN); Antsotso, 2.IV.2008, fr., *Rabenantoandro et al. 1911* (MO, P, TAN); ibid., 22.V.2006, fr., *Randriatafika et al. 676* (MO, P, TAN); ibid., 8.XII.2007, ♂ fl., *Razakamalala et al. 3771* (MO, P, TAN); ibid., 1.IV.2014, ster., *Razakamalala 7737* (MO, P, TAN); ibid., 11.II.2019, ster., *Razakamalala et al. 8285, 8286, 8289* (DBEV, G, MO, P, TAN); Antanitsara, 5.XI.2019, y.fr., *Razakamalala & Andrianarivelo 8563* (DBEV, MO, P, TAN).

12. ***Diospyros mucronata*** Lowry, G.E Schatz, A.G. Linan & H.N. Rakouth, **sp. nov.** (Fig. 6E, 9).

Holotypus: Madagascar. Reg. SAVA [Prov. Antsiranana]: Andapa, Doany, Andranomololo, 10 km au SW du village d'Andranomololo, Andramanalana, 14°21'34"S 49°22'35"E, 738 m, 5.V.2006, fr., *Rakotovao 3202* (MO-6175737!; iso-: G [G00642211] image!, P [P03829492]!, TAN).

Diospyros mucronata Lowry, G.E Schatz, A.G. Linan & H.N. Rakouth can be distinguished from the species it most closely resembles vegetatively, D. farankarainensis Lowry, G.E Schatz, A.G. Linan & H.N. Rakouth and D. rakotovaoi G.E. Schatz & Lowry, by its leaves with a rounded to acute apex (vs. acuminate in D. farankarainensis) as well as its sessile fruits (vs. pedicellate) and mature fruiting calyx whose lobes have distinctly revolute margins along their entire length (vs. flat to somewhat revolute toward the base).

Tree 9–14 m tall, 12–14 cm DBH. *Stem* shoot apex without numerous cataphylls prior to extension, young stems densely covered with straight semi-appressed to erect golden trichomes < 0.5 mm long, mature stems reddish-brown to light gray. *Leaves* alternate, lamina 6–14 × 2–4 cm, oblong to elliptic, rarely narrowly obovate, subcoriaceous, densely covered with same indument as that of stems when very young, retaining sparse, appressed indument on both surfaces, denser along lower midrib, less so along secondaries, trichomes otherwise same as those of young stems, glabrescent elsewhere, base cuneate to attenuate, margin slightly undulate and often ciliate, apex rounded to acute, with distinct mucro 2–3 mm long, midvein impressed on adaxial surface, raised below, venation weakly brochidodromous, secondary veins 14–17 per side, flush on both surfaces; petiole 5–8 mm long, 1.5–2 mm in diam., with moderately dense indument same as on lamina. *Male flowers* (known only from material in bud) borne in axillary, 4(–6?)-flowered cymose inflorescences, the main axis (peduncle) 1–10 mm long, 1 mm in diam., densely covered with erect, straight, golden trichomes c. 0.5 mm long, pedicel c. 1–2 mm long, c. 1 mm in diam., densely covered with erect, straight, golden trichomes c. 0.5 mm long (flowers sometimes subsessile). *Female flowers* not seen. *Fruits* axillary, solitary, sessile, abscission zone 5.7–5.9 mm in diam.; fruiting calyx accrescent, shallowly cupuliform, densely covered with persistent indument like that on the fruit, the united portion 3–4 × 2–3 mm, the lobes 4–5, triangular, 10–15 × c. 12 mm, spreading slightly, such that the apex is not appressed to the fruit surface, margins revolute along the entire length, apex acute; fruit 4(–5?)-locular, spheroid to slightly oblate spheroid, 15–18 × 16–18 mm, the apex round to nearly flattened, with astylar remnant, surface smooth, densely covered with straight, erect, light brown trichomes 0.5–1 mm long, persistent. *Seeds* not seen.

Etymology. – The name chosen for this species reflects the fact that its leaves have an apex with distinct mucro 2–3 mm long (Fig. 9B), a feature shared with several other members of the Tetraclis group.

Distribution and ecology. – *Diospyros mucronata* is distributed in northern of Madagascar, from the Sorata forest south to the Anjanaharibe-Sud reserve (Fig. 8). It can be found in mid-elevation humid forests from 750 to 1500 m.

Phenology. – Fruiting collections have been recorded in March and May.

Conservation status. – *Diospyros mucronata* has a geographic range in the form of an EOO of 1,646 km^2 and a minimum AOO of 28 km^2 (both within the limits for "Endangered" status under criterion B). It occurs in two protected areas, COMATSA Nord and Anjanaharibe-Sud, where it has been recorded from near the limits of these reserves, as well as from unprotected forests, all of which are subjected to forest clearing for slash and burn agriculture, exploitation of trees for firewood, and house construction material, all of which are projected to result in continuing decline in EOO, AOO, quality of habitat, number of locations or subpopulations, and number of mature individuals. With respect to the most serious plausible threat of forest clearing for slash and burn agriculture, it exists at six locations. *Diospyros mucronata* is therefore assessed as "Vulnerable" [VU B1ab(i,ii,iii,iv,v)+2ab (i,ii,iii,iv,v)].

Notes. – *Diospyros mucronata* is known only from three blocks of mid-elevation humid forest in the far north of the island, the Sorata forest to the WSW of Vohemar, a series of sites to the NW of Doany, and the Anjanaharibe-Sud reserve S of Doany (Fig. 8). While, as indicated above, it most closely resembles *D. farankarainensis* vegetatively, its leaves are also similar to those of certain rather atypical collections of *D. rakotovaoi* in having elliptic blades that dry darker on the adaxial than the abaxial surface and have an acute to acuminate apex, but *D. mucronata* differs in having a flat to slightly raised midvein on the adaxial surface (vs. distinctly channeled in *D. rakotovaoi*).

Additional specimens examined. – Madagascar. **Reg. DIANA [Prov. Antsiranana]:** forêt dense sub-humide de moyenne altitude, à 10 km à vol d'oiseau du fkt. d'Antsahavalany, 13°44'10"S 49°23'07"E, 1299 m, 27.X.2007, bud, *Randriambololomamonjy 172* (MO, P, TAN). **Reg. SAVA [Prov. Antsiranana]:** Ankarongameloka forest, 14°15'41"S 49°25'55"E, 1129 m, III.2006, fr., *Antilahimena 4723* (G, K, MO, P, TAN); Andranomilolo, au pied du sommet d'Anjanaharibe "Nord", 14°18'06"S 49°18'40"E, 1488 m, 20.XI.2006, bud, *Rakotovao 3451* (MO, P, TAN); forêt de Sorata, 13°41'56"S 49°26'30"E, 1308 m, 4.XI.2007, bud, *Randriambololomamonjy 241* (G, MO, P, TAN); RS Anjanaharibe-Sud, piste vers le sommet, 14°39'30"S 49°29'30"E, 1010 m, 16.XI.1995, bud, *Ravelonarivo 908* (MO, P); forêt Sorata, 13°38'51"S 49°32'02"E, 1066 m, 9.XI.2007, bud, *Razakamalala 3706* (G, MO, P, TAN).

13. ***Diospyros parifolia*** H. Perrier in Mém. Inst. Sci. Madag., Sér. B, Biol. Vég. 4: 146. 1952 (Fig. 6F).

Holotypus: Madagascar. **Reg. Boeny [Prov. Mahajanga]:** près du Mt Anemboambo (Ambohinambo de la carte) au N de Majunga, [22°17'35"S 46°17'59"E], 800 m, XII.1921, fr., *Perrier de la Bâthie 13836* (P [P00541773]!, iso-: P [P00541774]!, MARS [MARS04955] image!).

Tree 6–16 m tall, 7–25 DBH. *Stem* shoot apex without numerous cataphylls prior to extension, young stems moderately densely covered with semi-erect light brown trichomes c. 0.3–0.5 mm long, mature stems lenticellate, reddish-brown to gray, occasionally glaucescent. *Leaves* opposite, lamina 6–13 × 2–5.5 cm, obovate to elliptic, rarely oblong, coriaceous, initially moderately covered with appressed to semi-appressed light brown trichomes < 0.5 mm long on both surfaces, glabrescent, base obtuse to cuneate, margin slightly thickened on abaxial surface, initially ciliate, glabrescent, apex rounded to rarely rounded-acute, midvein impressed on adaxial surface, raised on abaxial surface, venation weakly brochidodromous, secondary veins c. 6–11 per side, flush and obscure on both surfaces; petiole 10–25 mm long, 1.4–2.5 mm in diam., moderately covered with trichomes like those of young leaves, glabrescent. *Male flowers* borne in axillary, 4–8(–9)-flowered umbellate inflorescences, the main axis (peduncle) 4–9 mm long, 1–1.5 mm in diam., moderately to sparsely covered with semi-appressed, straight, golden trichomes 0.2–0.3 mm long, pedicel 5–7 mm long, 1 mm in diam., densely covered with semi-appressed, straight, golden trichomes 0.2–0.3 mm long; calyx cupuliform, densely covered with appressed, golden trichomes c. 0.25 mm long, united portion 2–2.5 mm long, c. 5 mm in diam., the lobes 4 rounded triangular, 1–2 × 3–3.5 mm; corolla fleshy, cupuliform, moderately densely covered outside and inside with straight, appressed, golden trichomes c. 0.5 mm long, corolla tube c. 1.5 mm long, the 4 lobes slightly imbricate, rounded-triangular to somewhat obovate, 5 × 5 mm; stamens 22–26, subsessile, attached to the corolla at two levels, 1.5–2 mm above the base, and c. 0.5 mm higher, anthers 2.5–3 mm long, apically dehiscent; pistillode discoid, 0.5–1 mm long, 2 mm in diam., densely covered with straight, erect, golden trichomes c. 0.5 mm long. *Female flowers* not seen. *Fruits* axillary, solitary, pedicel in fruit very short or fruit subsessile, abscission zone 5.9–6.8 mm in diam.; fruiting calyx accrescent, shallowly cupuliform, densely covered with persistent, semi-erect, blonde to light brown trichomes c. 0.25–0.4 mm long, the united portion c. 5 × 2–3 mm, the lobes 4, triangular, c. 10 × 12 mm, appressed to the fruit surface or nearly so, margins flat to reflexed, more so toward the base such that occasionally the margins extend below the sinuses

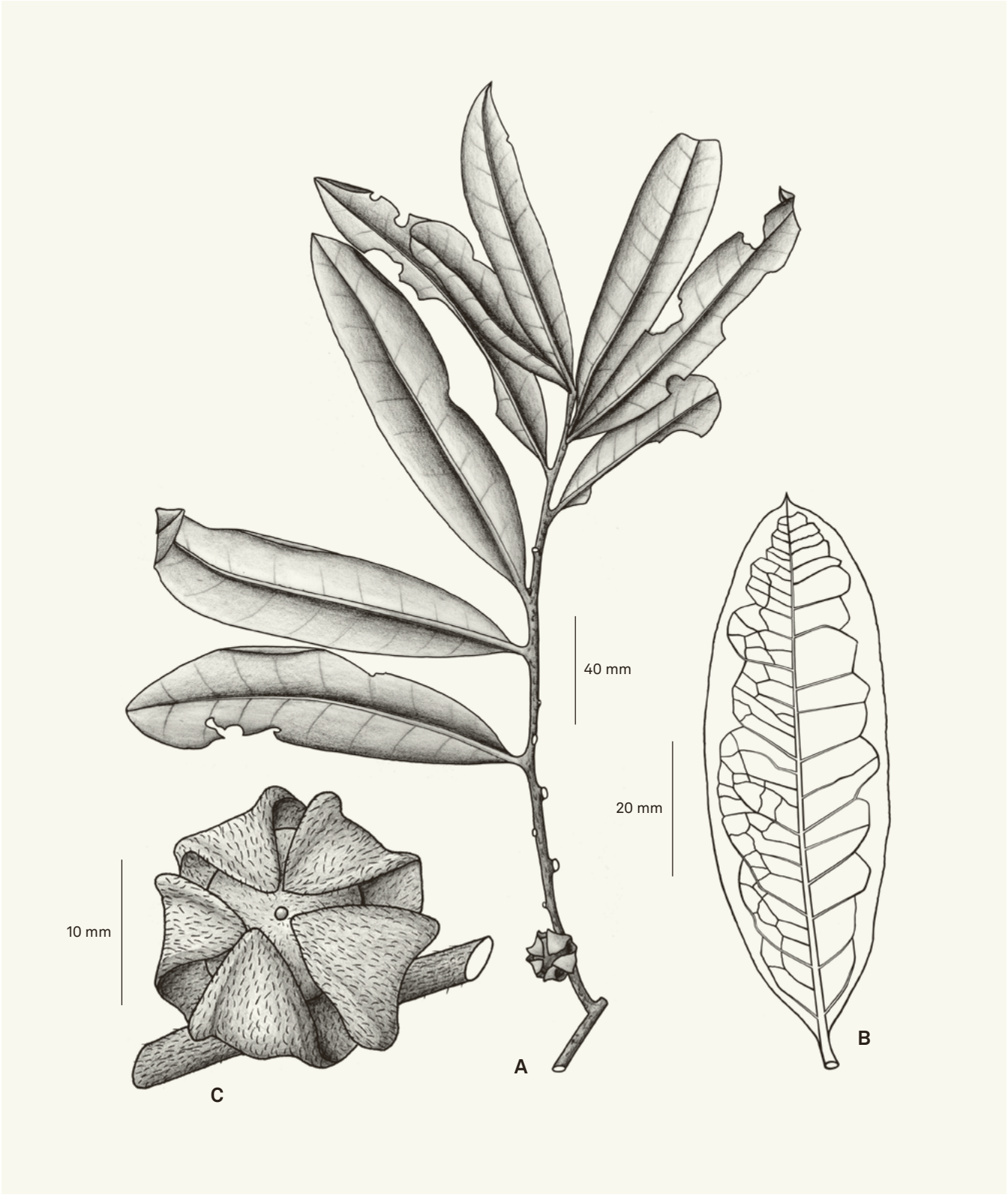

Fig. 9. – *Diospyros mucronata* Lowry, G.E. Schatz, A.G. Linan & H.N. Rakouth. **A.** Branch with young fruit; **B.** Detail of leaf (abaxial surface); **C.** Young fruit.
[**A, C:** *Antilahimena 4723*, P; **B:** *Ravelonarivo 908*, P] [Drawing: Alain Jouy]

onto the calyx cup, apex acute; fruit 4-locular, spherical to broadly ovoid, 25–26 × 25–27 mm, the apex round, with a stylar remnant, surface slightly verrucose, initially sparsely covered with straight appressed blonde trichomes, 0.4–0.5 mm long, glabrescent. *Seeds* not seen.

Vernacular names and uses. – "Ampelabemainty" (*Rakotonandrasana 924*), "Lopingo" (*Randrianasolo 605*), "Mapingo" (*Rakotovao 7320*), "Marandravina" (*Ratovoson 1087*), "Marandravy" (*Ranirison 619*), "Pingo" (*Pichon 97*, *123*).

Distribution and ecology. – *Diospyros parifolia* is distributed along the western coast of Madagascar, from Tsingy de Bemaraha Reserve in the Melaky region north to the Sahafary forest in the DIANA region. It can be found in dry deciduous forests at low elevations up to 500 m, growing on sand and limestone (Tsingy).

Phenology. – Flowering material has been collected in November, December, and February; fruiting collections have been recorded throughout most of the year.

Conservation status. – The risk of extinction of *Diospyros parifolia* was recently assessed by Faranirina et al. (2019c) as "Near Threatened" [NT] and no update is required.

Notes. – *Diospyros parifolia* stands out among members of the Tetraclis group in having leaves that are opposite (a feature that is very rare in the genus) and particularly coriaceous.

Additional specimens examined. – Madagascar. **Reg. Boeny [Prov. Mahajanga]:** Commune de Mariarano, Fokontany Antanandava, 15°28'03"S 46°41'41"E, 24 m, 15.VI.2021, ster., *Andrianarivelo 272, 273, 274, 275, 276* (DBEV, MO, P, TAN); Commune de Mariarano, Fokontany Antanandava, Alan'i Jerome, 15°27'27"S 46°41'27"E, 60 m, 24.II.2022, ster., *Andrianarivelo 445, 446, 447, 448, 449* (DBEV, MO, P, TAN); ibid., fl., *Andrianarivelo 450* (DBEV, MO, P, TAN); ibid., 15°27'29"S 46°41'28"E, 72 m, 26.II.2022, ster., *Andrianarivelo 451* (DBEV, MO, P, TAN); ibid., 15°27'30"S 46°41'28"E, 62 m, 26.II.2022, ster., *Andrianarivelo 452, 453* (DBEV, MO, P, TAN); ibid., 15°27'30"S 46°41'27"E, 58 m, 26.II.2022, ster., *Andrianarivelo 454, 455* (DBEV, MO, P, TAN); Katsepy, station d'Antrema, forêt de Badrala (kely), 15°42'37"S 46°09'06"E, 2.XI.2010, ster., *Pichon 97* (P); ibid., 15°45'S 46°14'E, 25.XI.2010, *Pichon 123* (P); Commune de Mariarano, Fokontany d'Antanambao, au N d'Antanambao, 15°23'59"S 46°49'43"E, 45 m, 17.IX.2017, fr., *Rakotovao 7320* (MO, P, TAN); station d'Antrema, 16°00'S 45°44'E, VII.2010, fr., *Ranaivoson 152* (B, G, MO, P, TEF); Commnune de Mariarano, Fokontany Tanambao, forêt Bedo, 15°28'02"S 46°49'14"E, 58 m, 17.IX.2017, fr., *Razakamalala 8132* (MO, P, TAN); ibid., 15°23'08"S 46°48'41"E, 32 m, 17.IX.2017, fr., *Razakamalala 8136* (MO, P, TAN); Commune de Mariarano, Fokontany Antanandava, Alan'i Jerome, 15°27'32"S 46°38'29"E, 70 m, 16.VI.2021, ster., *Razakamalala 8913, 8915* (DBEV, MO, P, TAN); ibid., fr., *Razakamalala 8914* (DBEV, MO, P, TAN); ibid., 15°27'33"S 46°38'26"E, 26 m, 16.VI.2021, ster., *Razakamalala 8916, 8917* (DBEV, MO, P, TAN); ibid., 15°27'31"S 46°38'27"E, 40 m, 16.VI.2021, ster., *Razakamalala 8918, 8919, 8920, 8921* (DBEV, MO, P, TAN); ibid., 15°27'29"S 46°38'31"E, 44 m, 16.VI.2021, ster., *Razakamalala 8923* (DBEV, MO, P, TAN); ibid., 15°27'28"S 46°38'27"E, 33 m, 16.VI.2021, ster., *Razakamalala 8924, 8925, 8926, 8927* (DBEV, MO, P, TAN); ibid., 15°27'26"S 46°41'26"E, 103 m, 27.II.2022, bud, *Razakamalala 9049* (DBEV, G, MO, P, TAN); Ampotsia, Katsepy, 24°47'56"S 46°40'24"E, 160 m, 27.IX.1954, fr., *Service Forestier 11042* (MO, P, TAN); partie N de la forêt de Tsiombikibo, au S du Cap Tanjona (Mitsinjo), [25°02'59"S 46°57'00"E], 19.XI.1965, fr., *Service Forestier (Capuron) 24218* (MO, P, TAN). **Reg. DIANA [Prov. Antsiranana]:** forêt Sahafary (Andamasina), 22°24'04"S 46°08'00"E, 24.II.2006, fr., *Guittou 284* (P); Tanambao-Marivorahona à 5 km à l'E de Betsimiranjana, Andohanantsohihy, 22°24'S 46°18'E, 700 m, 3.VII.2005, fr., *Léopold 89* (P); ibid., 15.VII.2005, fr., *Rakotonandrasana 924* (P). **Reg. Melaky [Prov. Mahajanga]:** Beanka, partie sud, Kinahango, 18°01'33"S 44°30'47"E, 316 m, 25.XI.2011, fl., *Gautier 5732* (G, MO, P, TEF); Beanka, S de la Kimanambolo, 18°05'28"S 44°33'00"E, 340 m, 14.XII.2012, fl., *Luino 27* (G, P); Beanka, partie nord, 18°07'54"S 44°29'55"E, 198 m, 7.III.2013, fr., *Luino 65* (G, MO, P); RN Bemaraha, Bekopaka, [18°39'06"S 44°42'12"E], 8.VII.1970, ster., *Rakotozafy 1010* (K, MO, P, TAN); Beanka, Ambinda-Nord, 17°55'19"S 44°28'56"E, 292 m, 12.XI.2011, fr., *Tahinarivony 593* (G, MO, P). **Reg. SAVA [Prov. Antsiranana]:** Ampondrabe, à l'W d'Ambarilao, forêt d'Ampondrabe, 12°57'48"S 49°41'57"E, 427 m, 24.IX.2007, fr., *S. Randrianasolo 605* (P); ibid., 12°58'S 049°42'E, 10.IV.2004, fr., *Ranirison 619* (G, MO, P, TAN, TEF); ibid., 12°58'26"S 49°41'50"E, 400 m, 6.XI.2005, fr., *Ratovoson 1087* (P). **Reg. Sofia [Prov. Mahajanga]:** Befandriana, Tsarahonenana, [15°25'00"S 048°16'00"E], [200 m], 27.X.1950, fr., *Service Forestier 1291* (MO, P, TAN, US); Antatikorija, Analalava, [14°42'30"S 47°28'00"E], 8.VIII.1954, fr., *Service Forestier 10399* (P, TEF); Canton de Tsarahonenana, forêt d'Anapondo, au SE d'Ambohimarina, 27.X.1950, ster., *Service Forestier 2-R-158* (P); Maromotso, Analalava, [14°38'00"S 47°45'00"E], 13.X.1954, ster., *Service Forestier 132-R-130* (P).

14. ***Diospyros rakotovaoi*** G.E. Schatz & Lowry in Candollea 76: 232. 2021 (Fig. 6G).

Holotypus: Madagascar. Reg. SAVA [Prov. Antsiranana]: Antsahaberaoka, 21.II.2007, fr., *Rakotovao et al. 3692* (MO-6214314!; iso-: P [P04539975]!, TAN [TAN002010]!).

Tree 6–25 m tall, 6–15 cm DBH. *Stem* shoot apex without numerous cataphylls prior to extension, young stems densely covered with slightly curly, erect light brown trichomes, c. 0.5 mm long, mature stems lenticellate, reddish-brown to gray. *Leaves* alternate, lamina 6.5–14.5 × 2.3–5.6 cm, obovate or sometimes elliptic, subcoriaceous to coriaceous, glabrous and shiny on adaxial surface, initially densely covered with semi-erect, grayish-white trichomes c. 1 mm long along the midvein and secondary veins on abaxial surface, glabrescent, base cuneate, margin flat to slightly thickened on abaxial surface, apex rounded to acute, occasionally with a distinct mucro c. 1 mm long, midvein distinctly channeled on adaxial surface, raised on abaxial surface, venation brochidodromous, secondary veins 7–9 per side; petiole 5–15 mm long, 1.7–2.4 mm in diam. *Male flowers* borne in axillary, 3–7-flowered cymose inflorescences, the main axis (peduncle) 2–3 mm long, 1.5 mm in diam., densely covered with erect, rusty brown trichomes 0.3 mm long, secondary axis 5–8 mm long, pedicel 2–3 mm long, 1.5 mm in diam.; calyx 3–4-lobed, the lobes c. 4 × 5 mm, broadly triangular; corolla 3–4-lobed, the lobes valvate; stamens 8, inserted in a single whorl on the corolla c. ⅓ from the base, filaments 3 mm long, anthers 3 mm long, dehiscing by

apical pores. *Female flowers* solitary, axillary, sessile to subsessile; calyx 4-lobed, the lobes rounded triangular, 6–8 × 5 mm; corolla 4-lobed, the lobes valvate, triangular, 4 × 3–4 mm; styles not seen. *Fruits* axillary, solitary, sessile or pedicel in fruit to c. 4 mm long, 3 mm in diam., densely covered with erect, rusty brown trichomes 0.3 mm long, distal abscission zone 4–8.1 mm in diam.; fruiting calyx accrescent, shallowly cupuliform, densely covered with persistent, erect, rusty brown trichomes 0.3 mm long, the united portion 6–8 × 22 mm, the lobes 4, broadly triangular, 10–12 × 17–19 mm, spreading slightly, such that the apex is not appressed to the fruit surface, margins flat and slightly thickened throughout, rarely extending less than 1 mm below the sinuses onto the calyx cup, apex acute; fruit c. 4-locular, spherical to broadly ellipsoid, 26–31 × 21–40 mm, the apex rounded, with stylar remnant, surface verrucous, densely covered with persistent, erect, rusty brown trichomes 0.3 mm long. *Seeds* not seen.

Distribution and ecology. – *Diospyros rakotovaoi* occurs in the mountains of northern and east-central Madagascar, from Montagne d'Ambre National Park in the north and the Sambirano region in the northwestern part of the island at the Galoko-Kalobinono and Tsaratanana protected areas (Madagascar Catalogue, 2024), south to the Betampona Strict Nature Reserve. It is found in humid to subhumid forest at 600–1400 m elevation, rarely extending down to as low as 300 m.

Phenology. – Flowering material has been collected in May and November, and specimens with fruit have been recorded throughout most of the year.

Conservation status. – *Diospyros rakotovaoi* has a geographic range in the form of an EOO of 66,803 km² (exceeding the limit for "Vulnerable" status under criterion B1) and a minimum AOO of 80 km² (falling within the limits for "Endangered" status under criterion B2). Its distribution is wholly contained within nine protected areas, Anjanaharibe-Sud, COMATSA Nord, Galoko-Kalobinono, Loky Manambato, Makirovana, Marojejy, Masoala, Montagne d'Ambre, and Tsaratanana. However, several localities are situated near the forest edge, where there are active threats due to forest clearing for agriculture, fire, and exploitation of trees for firewood and house construction material, which are projected to result in continuing decline of quality of habitat and number of mature individuals. With respect to the most serious plausible threat of exploitation of trees for firewood and house construction material, *D. rakotovaoi* exists at 13 locations. Thus, based on the new circumscription explained below in the Notes section and additional occurrences recorded since the recent publication on the IUCN Red List of an assessment as "Vulnerable" (Schatz & Lowry, 2021e), the assessment of this species is updated to "Near Threatened" [NT].

Notes. – Based on our comprehensive examination of material belonging to the Tetraclis group, we have expanded the circumscription of *Diospyros rakotovaoi* beyond the original delimitation of Schatz et al. (2021b) to include collections whose leaves are sometimes elliptic and/or have an acute apex, in addition to material with obovate leaves and a rounded apex (see Schatz et al., 2021b, fig. 17). This species can develop into a large tree species and therefore a potential source of ebony (Lowry et al., 2024), so precise locality information has been withheld.

Additional specimens examined. – **Madagascar. Reg. Alaotra-Mangoro [Prov. Toamasina]:** Sahalampy à Ampitanonoka, 18.I.1945, fr., *Cours 24.31* (P). **Reg. Analanjirofo [Prov. Toamasina]:** Batona-Mananara, 25.XI.1951, fr., *Service Forestier 5803* (P, TEF). **Reg. Atsinanana [Prov. Toamasina]:** Betampona, 24.VIII.1950, fr., *Réserves Naturelles 2646* (P, TEF); ibid., 22.VIII.1957, *Service Forestier (Capuron) 18115* (P, TEF). **Reg. DIANA [Prov. Antsiranana]:** RNI Tsaratanana, Beangona-Ambevy, 31.VIII.2000, fr., *Antilahimena 596* (MO, P, TAN); Anketrabe, forêt de Kalabenono, chaine Galoko, 25.XI.2006, fl., *Razafitsalama 1141* (G, MO, P, TAN); Montagne d'Ambre, 25.V.2008, fl., *Trigui 409* (G, P, TEF). **Reg. SAVA [Prov. Antsiranana]:** Daraina, forêt d'Antsahabe, 26.XI.2004, fl., *Gautier 4755* (G, MO, P, TAN); massif de l'Anjanaharibe, 10.XII.1950, fr., *Humbert 24471* (G, K, MO, P); Masoala, Sahafary, 19.VII.1997, fr., *McPherson 17114* (G, MO, P); Analamaho, Tanandava, 25.V.2009, fr., *Raharimampionona* 303 (MO, P, TAN, TEF); SW d'Andranomololo, 5.V.2006, ster., *Rakotovao et al. 3147* (MO, P, TAN); Anjanaharibe-Sud, Andranotsarabe, Ambatomainty, 3.XI.1994, fr., *Ravelonarivo 508* (L, MO, P, TAN, WAG); Morafeno, forêt d'Antsahandroboka, 6.II.2006, fr., *Razakamalala 3190* (G, MO, P, TAN); Ampitambarimena, 27.III.1955, *Réserves Naturelles 7045* (G, MO, P, TEF); Antongopahitra, Ambohimalaza, 17.IX.1957, fr., *Réserves Naturelles 9233* (MO, P, TEF); RN 12 [Marojejy], 1963, fr., *Service Forestier 21635* (P, TEF); Sahamalaza, Manarivola, 28.X.1994, fr., *Service Forestier 34600* (P, TEF). **Reg. Sofia [Prov. Mahajanga]:** Anjanaharibe-Sud, 9.XI.1999, fr., *Rakotomalaza 2145* (G, P, MO, TEF). **Reg. Vakinankaratra [Prov. Antananarivo]:** Ambodiriana, 14.XII.1944, fr., *Cours 1893* (P).

15. ***Diospyros sambiranensis*** A.G. Linan, H.N. Rakouth & Lowry, **sp. nov.** (Fig. 6H, 10).

Holotypus: Madagascar. Reg. DIANA [Prov. Antsiranana]: Ambilobe, Beramanja, Anketrabe, forêt de Kalabenono [= Kalobinono], chaine de Galoko, 8 km au SE d'Anketrabe, 13°38'27"S 48°40'05"E, 338 m, 19.XI.2006, fr., *Razafitsalama 1069* (MO-6104123!; iso-: G [G00360419]!, P [P00722729]!, TAN).

Diospyros sambiranensis A.G. Linan, H.N. Rakouth & Lowry can be distinguished from the species it most closely resembles vegetatively, D. fuscovelutina Baker, by its leaves, which dry brown (vs. khaki green) on the adaxial surface, as well as its fruit with a rounded to slightly flattened apex (vs. rostrate) covered in reddish-brown (vs. light brown) trichomes.

Shrub to small tree 7–8 m tall, 7–10 cm DBH. *Stem* shoot apex without numerous cataphylls prior to extension, young stems densely covered with straight, erect to semi-appressed, dark brown to reddish-brown trichomes 0.5–1 mm long, mature stems dark brown. *Leaves* alternate,

lamina 10.5–19.5 × 4.4–6.6 cm, elliptic, coriaceous to subcoriaceous, initially densely covered throughout with straight, erect, reddish-brown to dark brown trichomes c. 0.5 mm long, persisting at maturity along the midrib, glabrescent elsewhere, base cuneate, margin revolute and densely ciliate, glabrescent, apex rounded to obtuse, midvein shallowly impressed on adaxial surface, raised on abaxial surface, venation weakly brochidodromous, secondary veins 14–19 per side, weakly visible to slightly raised on both surfaces; petiole 15–35 mm long, 2–3 mm in diam., densely covered with straight, erect, dark brown to reddish-brown trichomes 0.5–1 mm long. *Flowers* not seen. *Fruits* axillary, solitary, pedicel in fruit 9 mm long, 3 mm in diam., with same indument as the petiole, distal abscission zone 3.8–4.2 mm in diam.; fruiting calyx accrescent, shallowly cupuliform, densely covered with persistent, straight, erect, dark brown colored trichomes 1–2 mm long, the united portion 2–4 × 16–19 mm, the lobes 4, rounded-triangular, 16–22 × 9–10 mm, spreading slightly, such that the apex is not appressed to the fruit surface, margins flat, becoming reflexed toward the base, apex acute; fruit 4-locular, spherical, 21–25 × 21–27 mm, the apex rounded to somewhat flattened, surface verrucose, sparsely covered with persistent, straight, erect, dark brown to reddish-brown colored trichomes 1–2 mm long. *Seeds* not seen.

Etymology. – The name chosen for this species reflects the fact that it is known from only two locations, both situated in the Sambirano region of NW Madagascar.

Distribution and ecology. – *Diospyros sambiranensis* is restricted to the DIANA region of northwest of Madagascar (Fig. 8), where it is known from humid forests on rock or sand at 10–338 m elevation.

Phenology. – Fruiting collections have been recorded in November.

Conservation status. – *Diospyros sambiranensis* has a geographic range in the form of a minimum AOO of 8 km², falling within the limits for "Critically Endangered" status under the criterion B2. It is known from just two occurrences, one in the Galoko-Kalobinono Protected Area, and the other from unprotected forest, where it is facing forest clearing due to shifting agriculture, wildfires, grazing, and exploitation of trees for firewood and house construction material, all of which are projected to result in continuing decline in EOO, AOO, quality of habitat, number of locations or subpopulations, and number of mature individuals. With respect to the most serious plausible threat of exploitation of trees for firewood and house construction material, it exists at two locations. Therefore, *D. sambiranensis* can be assessed for its risk of extinction as "Endangered" [EN B2ab(i,ii,iii,iv,v)].

Notes. – *Diospyros sambiranensis* is known from only two collections, one with apparently mature fruit from c. 500 m elevation in the Galoka range, and another with immature fruit from much lower elevation forest (c. 10 m) in the Ambato classified forest, situated less than 25 km to the north-northeast. While it closely resembles *D. fuscovelutina*, it is clearly distinct, both in morphology (see the diagnosis presented above) and geography, with *D. sambiranensis* restricted to the northwestern part of Madagascar whereas the closest documented occurrence of *D. fuscovelutina* is located more than 150 km to the southeast in the northeastern part of the island (Fig. 8).

Additional specimen examined. – **Madagascar. Reg. DIANA [Prov. Antsiranana]:** Ambato classified forest, 200 m S of Ambatofaly River, Vavaranan' Ambatofaly, 13°26'42"S 48°44'24"E, 10 m, 22.XI.1996, fr., *Antilahimena 334* (MO, P).

16. ***Diospyros undulaticalyx*** A.G. Linan, H.N. Rakouth & Lowry, **sp. nov.** (Fig. 6I, 11).

Holotypus: Madagascar. Reg. Melaky [Prov. Mahajanga]: Beanka, S de la Kimanambolo, 2.XII.2012, fr., *Gautier 5912* (MO-6600123!; iso-: G [G00377848]!, K, P [P01060272]!, TEF).

Diospyros undulaticalyx A.G. Linan, H.N. Rakouth & Lowry can be distinguished from the species it most closely resembles vegetatively, D. urschii H. Perrier, by its young stems with shorter trichomes (0.5–1 mm vs. 2.5–3.0 mm in D. urschii) and its fruiting calyx with lobes whose margins are undulate and distinctly reflexed along their entire length (vs. non-undulate and less prominently reflexed), and it smaller fruits (15–22 × 15–20 mm vs. 22–26 × 21–25 mm).

Small tree 3–12 m tall, 7–20 cm DBH. *Stem* shoot apex without numerous cataphylls prior to extension, young stems moderately dense to sparsely covered with very distinct, straight, erect, light brown to blonde trichomes 0.5–1 mm long, mature stems lenticellate, reddish-brown to grayish brown. *Leaves* alternate, lamina 7–11 × 1.7–3.3 cm, elliptic, subcoriaceous, with sparse, straight, appressed, golden to light brown trichomes 1–1.5 mm long on both surfaces, mostly glabrescent, with indument persisting only along midvein on abaxial surface, base cuneate, margin slightly revolute, ciliate, apex acuminate, with a distinct mucro 1–2 mm long, very rarely rounded-obtuse and lacking a mucro, midvein slightly impressed on adaxial surface, raised on abaxial surface, venation weakly brochidodromous, secondary veins 12–19 per side, weakly visible to slightly raised on both surfaces; petiole 7–12 mm long, 1–1.5 mm in diam., sparsely to moderately densely covered with straight, erect, dark-rust colored trichomes 0.5–1 mm long, glabrescent. *Male flowers* (known from only a single insect damaged flower) axillary, borne in

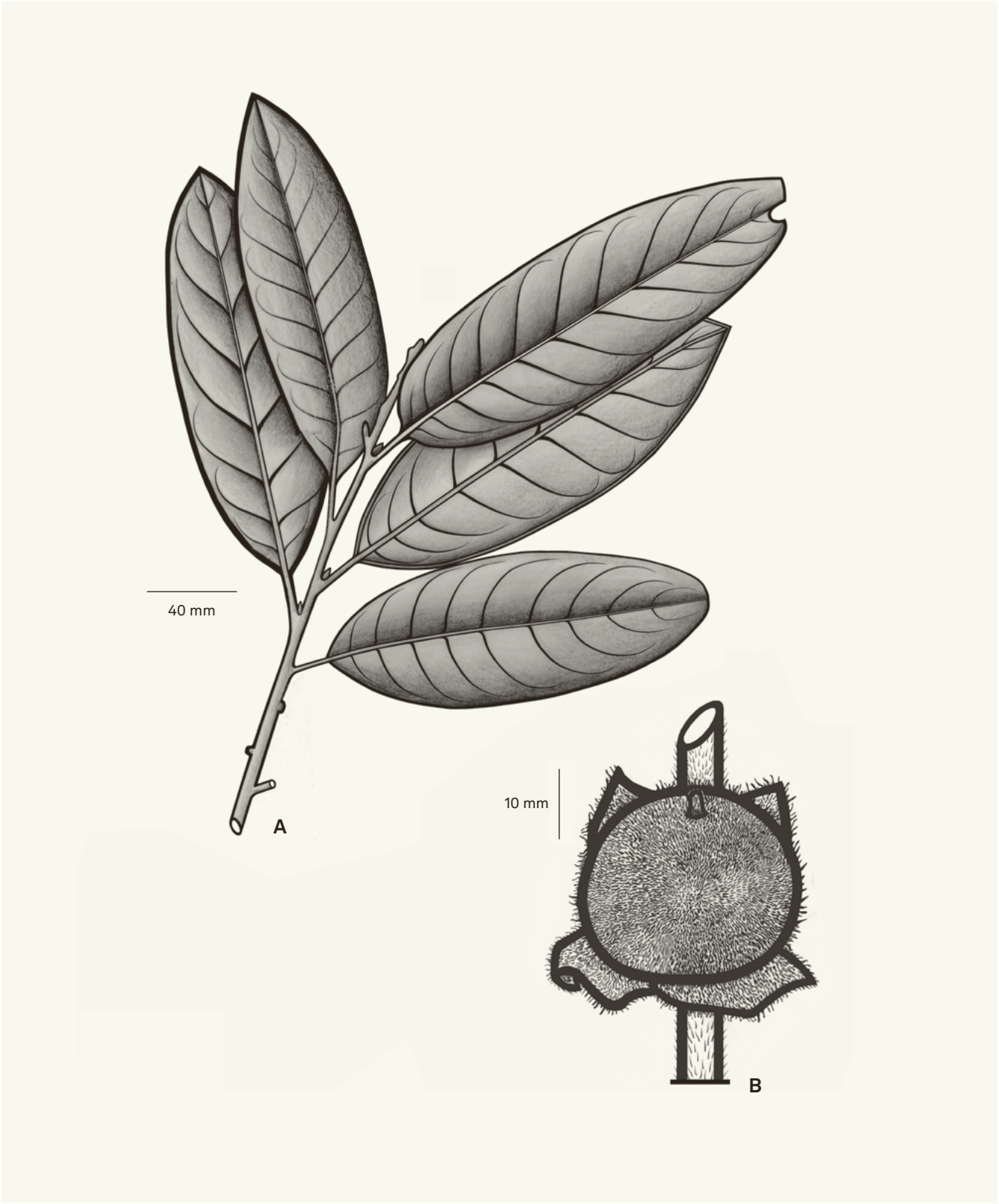

Fig. 10. – *Diospyros sambiranensis* A.G. Linan, H.N. Rakouth & Lowry. **A.** Branch with leaves; **B.** Fruit.
[**A, B:** *Razafitsalama 1069*, P] [Drawing: Alain Jouy]

6–8-flowered pseudo-umbellate inflorescences, the main axis (peduncle) 5–6.5 mm long, 1 mm in diam., densely covered with erect, straight, golden trichomes c. 0.25 mm long, pedicel c. 4–5 mm long, c. 1 mm in diam., densely covered with erect, straight, golden trichomes c. 0.25 mm long; calyx cupuliform, 2.5–3 × 2–2.5 mm, the 4 lobes triangular, c. 1 × 1 mm, densely covered with semi-appressed, golden trichomes c. 0.25 mm long; corolla tubular, 7–8 mm long, densely covered outside and inside with straight, straight, appressed, golden trichomes 0.25–0.5 mm long, the 4 lobes valvate, rounded-triangular, c. 1.5 mm long; stamens c. 16(–?), 3–3.5 mm long, attached to the corolla at two levels, 3.5–4 mm above the base and 0.5–1 mm higher, anthers 2–2.5 mm long, apically dehiscent; pistillode discoid, c. 0.5 × 1 mm, densely covered with straight, erect, golden to grayish trichomes 1–1.5 mm long. *Female flowers* not seen. *Fruits* axillary, solitary, subsessile or pedicel in fruit to c. 2 mm long, distal abscission zone 3.5–4.2 mm in diam.; fruiting calyx accrescent, shallowly cupuliform, densely covered with persistent, straight, erect to semi-erect, golden trichomes 0.5–1 mm long, the united portion 1–4 × 7–10 mm, the lobes 4, rounded-triangular, 7–11 × 5–7 mm, appressed or nearly so to the fruit surface, margins undulate and distinctly reflexed along the entire length, apex acute; fruit 2(–?)-locular, spherical to slightly ellipsoid, 15–22 × 15–20 mm, initially sparsely covered with straight, appressed to semi-erect, golden to rust colored 1–2 mm long trichomes, glabrescent, the apex rounded-acute, with a stylar remnant. *Seeds* spherical wedge-shaped (i.e. like the segment of an orange), 11–12 × 10–12 mm.

Etymology. – The name chosen for this species reflects the distinctively undulate margins of its fruiting calyx (Fig. 6I).

Distribution and ecology. – *Diospyros undulaticalyx* is distributed inland along the west coast of Madagascar from the Beanka Protected are in the Melaky region extending north to Pointe d'Ambalabongo in the Sofia region (Fig. 3). It can be found growing in dry to rarely subhumid forests on limestone (Tsingy) from 30 to 400 m elevation.

Phenology. – Flowering material has been collected in February, March, and October; fruiting collections have been recorded from October to January.

Conservation status. – *Diospyros undulaticalyx* has a geographic range in the form of an EOO of 19,452 km² (falling within the threshold for "Vulnerable" status under criterion B1) and a minimum AOO of 44 km² (which falls within the limits for "Endangered" status under criterion B2). It is present in the protected areas of Namoroka and Beanka. Outside the protected areas, and in some cases also within them, it is threatened by forest clearing for agriculture, fire, grazing, and exploitation for firewood and house construction material, all of which are projected to result in continuing decline in its quality of habitat and number of mature individuals. With respect to the most serious plausible threat of exploitation for firewood and house construction material, it exists at five locations. Therefore, *D. undulaticalyx* is provisionally assessed as "Endangered" [EN B2ab(iii,v)].

Notes. – *Diospyros undulaticalyx* vegetatively resembles *D. urschii* but can easily be distinguished by its fruiting calyx, whose lobes have margins that are distinctly undulate and highly reflexed (Fig. 6I), a feature that is strikingly different from the non-undulate and less prominently reflexed margins in *D. urschii* (Fig. 6J), and by it smaller fruits (15–22 × 15–20 vs. 22–26 × 21–25 mm). This is a large tree species and therefore a potential source of ebony (Lowry et al., 2024), so precise locality information has been withheld.

Additional specimens examined. – Madagascar. **Reg. Boeny [Prov. Mahajanga]:** Namoroka, 24.X.2019, fl., *Gautier 6275* (G, P); ibid., 11.IX.2012, ster., *Rakotovao 6063* (TAN). **Reg. Melaky [Prov. Mahajanga]:** Beanka, 23.II.2012, fl., *Bolliger 246* (G, MO, P); ibid., 27.XI.2012, fr., *Gautier 5854* (BR, G, K, MO, P, TEF); ibid., 6.I.2012, fr., *Hanitrarivo 76* (G, MO, P); ibid., 11.III.2012, fl., *Hanitrarivo 337* (G, K, MO, P, TEF, WAG); ibid., 16.XII.2011, fr., *Nusbaumer 3151* (G, P); ibid., 23.X.2009, fr., *Rakotonasolo 1448* (CAS, MO); ibid., 9.XI.2011, fr., *Tahinarivony 535* (G, K, MO, P, TEF, WAG). **Reg. Sofia [Prov. Mahajanga]:** NE d'Ambalatrinsy, 9.XI.2014, fr., *Rakotoarisoa 3449* (K, MO, P, TAN, TEF); forêt d'Ambondro-Ampasy, 29.X.1958, *Service Forestier 18855* (MO, P). **Sine loco:** 1892, fr., *Louvel s.n.* (P).

17. ***Diospyros urschii*** H. Perrier in Mém. Inst. Sci. Madag., Sér. B, Biol. Vég. 4: 150. 1952 (Fig. 6J).

Lectotypus (designated here): Madagascar. **Reg. DIANA [Prov. Antsiranana]:** forêt d'Analamaz[aotra], received 17.X.1927, fr., *Ursch 138* (P [P00573681]!). **Syntypus:** Madagascar. **Reg. DIANA [Prov. Antsiranana]:** env. de Diégo-Suarez, XI.1906, fr., *d'Alleizette s.n.* (P [P00573682]!).

Tree 3–12(–18) m tall, 3–18(–25) cm DBH. *Stem* shoot apex without numerous cataphylls prior to extension, young stems moderately densely covered with straight, erect dark brown trichomes 2.5–3 mm long, mature stems lenticellate, grayish brown. *Leaves* alternate, lamina 6–11 × 2.0–3.2 cm, oblong to narrowly elliptic, subcoriaceous, initially moderately densely covered on both surfaces with same indument as young stems, glabrescent, base cuneate, margin slightly revolute, ciliate, glabrescent, apex acute, often with an indistinct mucro c. 1 mm long, midvein flat to slightly impressed on adaxial surface, raised on abaxial surface, venation weakly brochidodromous, secondary veins c. 12–16 per side, weakly visible on both surfaces; petiole 8–13 mm long, 1–1.5 mm in diam., initially moderately densely covered with same indument as young stems, glabrescent. *Male flowers* (known only from immature material) borne in axillary, 2–3-flowered clusters,

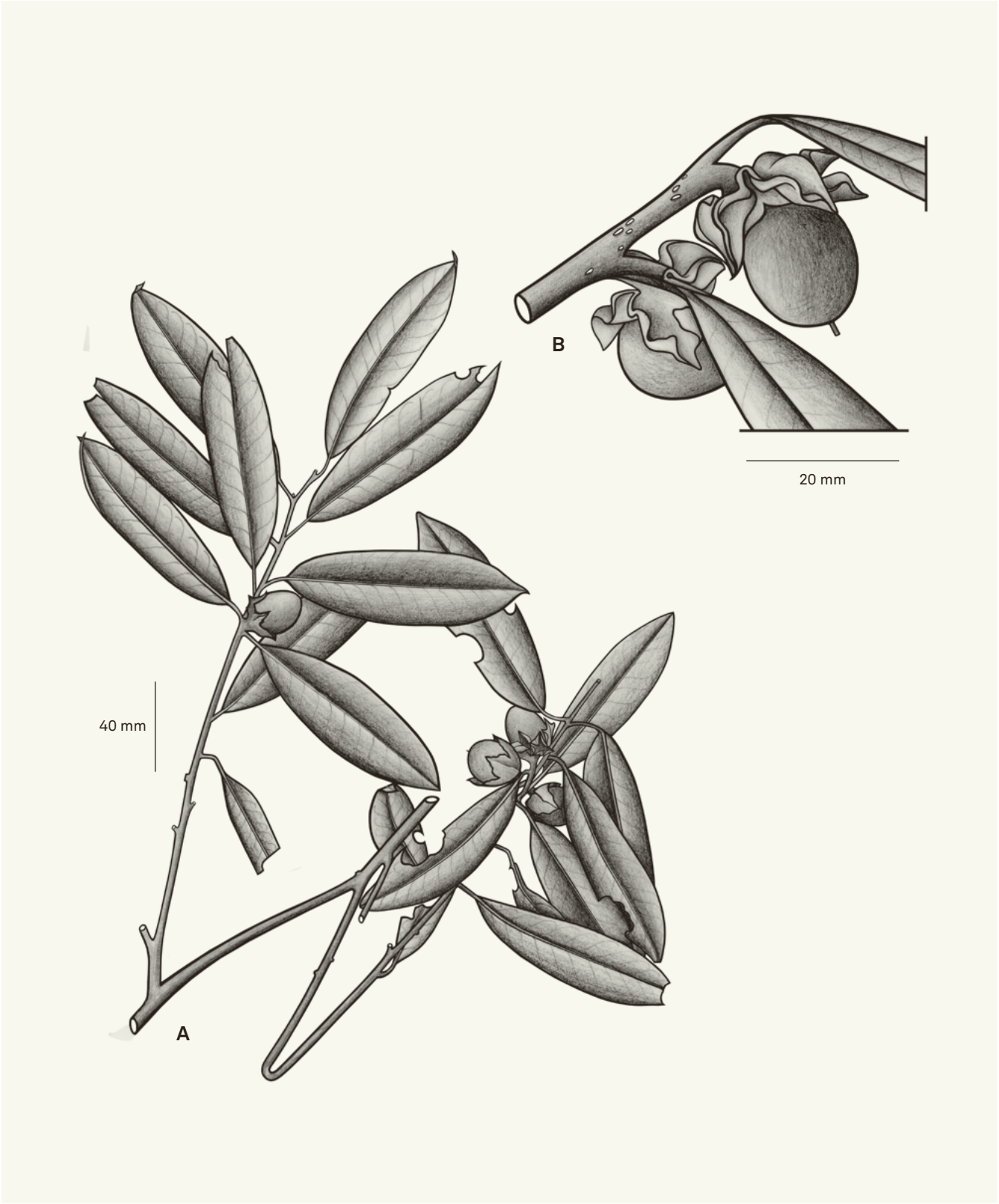

Fig. 11. – *Diospyros undulaticalyx* A.G. Linan, H.N. Rakouth & Lowry. **A.** Branch with fruits; **B.** Fruit.
[**A, B:** *Gautier et al. 5912*, P] [Drawing: Alain Jouy]

pedicel 4–5 mm long, 1 mm in diam, densely covered with erect to semi-appressed, straight, golden trichomes c. 0.25 mm long; calyx cupuliform, c. 2.5 × 2.5 mm, densely covered with appressed, golden trichomes c. 0.25 mm long, the 4 lobes triangular, 0.5 × 1 mm; corolla fleshy, cupuliform, 3.5–4 mm long, densely covered outside and inside with straight, appressed, golden trichomes c. 1 mm long, the 4 lobes valvate, rounded-triangular, c. 3 × 3 mm; stamens c. 16, subsessile, inserted in a single whorl on the corolla c. 1 mm above the base, anthers c. 2.5–3 mm long, apically dehiscent. *Female flowers* not seen. *Fruits* axillary, solitary, sessile, abscission zone c. 6.3 mm in diam.; fruiting calyx accrescent, shallowly cupuliform, densely covered with reddish-brown, erect trichomes 2.5–3 mm long, persistent, the united portion 1–3 × 10–12 mm, the lobes 4, triangular, 10–15 × 9–10 mm, appressed or nearly so to the fruit surface, margins flat, often becoming somewhat reflexed toward the base or sometimes nearly throughout, apex acute; fruit c. 2-locular, spherical to slightly ellipsoid, 22–26 × 21–25 mm, the apex rounded, surface, verrucose, initially densely covered with erect, reddish-brown trichomes 2.5–3 mm long, glabrescent. *Seeds* spherical wedge-shaped (i.e. like the segment of an orange), 13 ×13 mm.

Vernacular names and uses. – "Joby ampotorto" (*Andrianantoanina 878*), "Lazalaza (*Service Forestier 21342*), "Valisa" (*Razafitsalama 576*).

The wood of this species is reportedly used for construction (*Razafitsalama 576*).

Distribution and ecology. – *Diospyros urschii* is known from the DIANA region in northern Madagascar, where it has been recorded from the Analamerana reserve and the surrounding area, extending north to Montagne des Français and Montagne d'Ambre. It can be found in dry forests on sand and karstic limestone (Tsingy), from 30 to 700 m elevation.

Phenology. – Fruiting collections have been recorded in March and from October to January.

Conservation status. – *Diospyros urschii* has a geographic range in the form of an EOO of 1,102 km² and a minimum AOO of 32 km², values that fall within the limits for "Endangered" status under the criteria B1 and B2, respectively. All known occurrences are situated within protected areas (Analamerana, Montagne des Français, and Montagne d'Ambre), two of which are near the limits of Analamerana, where they are subjected to threats from shifting agriculture, wildfires, grazing, and exploitation of trees for firewood and house construction material, which are projected to result in continuing decline in quality of habitat and number of mature individuals. With respect to the most serious plausible threat of exploitation of trees for firewood and house construction material, the species is now known to exist at five locations, fewer that previous indicated when material now assigned to *D. undulaticalyx* was included in *D. urschii* for the assessment by Faranirina et al. (2019d). As a consequence, based on the narrower circumscription adopted here for *D. urschii*, the assessment of this species is updated to "Endangered" [EN B1ab(iii,v)+2ab(iii,v)].

Notes. – *Diospyros urschii* is one of three species in the Tetraclis group restricted to dry forests in far northern Madagascar, along with *D. antsirananae* and *D. vescoi*, from which it can easily be distinguished by its oblong to narrowly elliptic leaves (c. 3–5 times as long as wide) with an acute apex, vs. elliptic to obovate (1.7–2.75 times as long as wide) in *D. antsirananae* and obovate to nearly orbicular (1.1–2.3 times as long as wide) in *D. vescoi*. The leaves of *Diospyros urschii* also differ in having an apex that is acute whereas it is often rounded in the two other species, and sometimes emarginate in *D. vescoi*. This species is a large tree species and a potential source of ebony (Lowry et al., 2024), so precise locality information has been withheld.

Perrier de la Bâthie (1952a: 150) regarded the specimen labeled *d'Alleizette s.n.* as part of the collection *Ursch 138* and annotated P00573682 "part probable de *Ursch 138*". A mislabeling is possible, but there is no direct evidence linking the two specimens and we therefore consider them to represent two different gatherings collected c. 20 years apart. *Ursch 138* (P00573681) is designated here as the lectotype of the name *Diospyros urschii*.

Additional specimens examined. – **Madagascar. Reg. DIANA [Prov. Antsiranana]:** Analamera, 17.I.1995, bud, *Andrianantoanina 764* (MO, P, TAN, US); ibid., 30.X.1995, fr., *Andrianantoanina 878* (MO, P); ibid., 5.XI.1996, fr., *Andrianantoanina 1008* (MO, P, TAN, US); ibid., 8.III.2022, ster., *Karatra 514, 515, 516, 517, 520, 521, 522, 523* (DBEV, MO, P, TAN); ibid., fr., *Karatra 518, 519* (DBEV, MO, P, TAN); Ampitiliantsambo, 15.I.2005, fr., *Rakotonandrasana 903* (CNARP, MO, P, TAN); Montagne d'Ambre, 23.XII.2011, fr., *Randimbiarison 55* (G, K, MO, P, TEF, WAG); Analamerana, 11.XII.2021, ster., *Randrianaivo 3943, 3944, 3946, 3947, 3948, 3949, 3950, 3951, 3952, 3953* (DBEV, MO, P, TAN); ibid., 11.XII.2021, fr., *Randrianaivo 3945* (DBEV, MO, P, TAN); Montagne des Francais, 29.III.2004, *Razafitsalama 576* (CNARP, MO, P, TAN); Pic des Orchidées, 13.IX.1963, *Service Forestier 21342* (MO, P, TEF).

18. ***Diospyros vescoi*** Hiern in Trans. Cambridge Philos. Soc. 12: 218. 1873 (Fig. 6K).

Lectotypus (designated by Schatz & Lowry, 2011: 280): **Madagascar. Reg. DIANA [Prov. Antsiranana]:** Port-Leuven, III–IV.1849, fl., *Boivin 2539b* (P [P00573679]!; isolecto-: G [G00074123]!, P [P00573680]!).

Tree 3–23 m tall, 3–28 cm DBH. *Stem* shoot apex without numerous cataphylls prior to extension, young stems densely covered with straight, semi-appressed, light brown trichomes

c. 0.5 mm long, mature stems gray. *Leaves* alternate, lamina 4–8.5(–14) × 3.5–5.7(–14) cm, obovate to nearly orbicular, subcoriaceous to coriaceous, initially moderately densely covered on both surfaces with same indument as young stems, glabrescent on adaxial surface, persistent on abaxial surface, base rounded-obtuse, rarely cuneate, margin thickened on abaxial surface to slightly revolute, initially only slightly ciliate, glabrescent, apex rounded to emarginate, midvein flat to slightly impressed on adaxial surface, raised on abaxial surface, venation weakly brochidodromous, secondary veins 5–8 per side, slightly raised on adaxial surface, distinctly raised on abaxial surface; petiole 10–20 mm long, 2–2.5 mm in diam., initially moderately densely covered with same indument as young stems, glabrescent. *Male flowers* borne in axillary, 4–5-flowered pseudo-umbellate inflorescences, the main axis (peduncle) 10–15 mm long, 1 mm in diam., densely covered with erect, straight, golden trichomes c. 0.25 mm long, pedicel c. 5–8 mm long, c. 1 mm in diam., densely covered with erect, straight, golden trichomes c. 0.25 mm long; calyx cupuliform, densely covered with semi-appressed, light brown to whitish trichomes c. 0.25 mm long, united portion 4 mm long, 6–6.5 mm in diam., the 4 lobes triangular, 2–2.5 × 3 mm; corolla tube 5 mm long, densely covered outside and inside with straight, appressed, light brown to whitish trichomes 0.2–0.3 mm long, the 4 lobes slightly imbricate, rounded-triangular, c. 2 × 3 mm; stamens 8–16(?), subsessile, attached to the corolla at a two levels, 2–2.5 mm above the base and 0.5–1 mm higher, anthers 2–2.5 mm long, apically dehiscent; pistillode discoid, c. 0.5 × 2 mm, densely covered with straight, erect, golden to grayish trichomes c. 0.5 mm long. *Female flowers* not seen. *Fruits* axillary, solitary, subsessile or pedicel in fruit to 2–3 mm long, distal abscission zone 3.6–5.6 mm in diam.; fruiting calyx accrescent, shallowly cupuliform, densely covered with persistent, light brown, erect trichomes c. 0.5 mm long, the united portion 2–4 × 10–12 mm, the lobes 4, rounded-triangular, 5–7 × 6–7 mm, spreading, not appressed to the fruit surface, margins slightly thickened to very slightly reflexed along entire length, apex acute; fruit c. 2-locular, spherical to very rarely ellipsoid, 20–27 × 19–26 mm, the apex rounded, surface smooth, initially densely covered with semi-appressed, light brown, trichomes c. 0.5 mm long, glabrescent. *Seeds* not seen.

Vernacular names and uses. – "Anganaroala" (*Rakotonandrasana 1176*), "Handanaroala" (*Guittou 121*), "Hazomafana" (*Be 81*), "Joby Ampototra" (*Bernard 2912–2922*), "Mampingo" (*Service Forestier 10011*, *10504*, *10505*), "Mapingo" (*De Block 156*, *Rakotonandrasana 1159*, *Randriamahazomanana 253*).

This species has been reported to be used for the production of posts (*Rakotonandrasana 1159*).

Distribution and ecology. – *Diospyros vescoi* is restricted to the north and far north of Madagascar, in the DIANA and SAVA regions. It can be found growing in dry, littoral, and rarely sub-humid forests on sand and karstic limestone (Tsingy), from 0 to 400 m elevation.

Phenology. – Flowering material has been collected from November to March, and very rarely in July; fruiting collections have been recorded throughout the year.

Conservation status. – The risk of extinction of *Diospyros vescoi* was recently assessed by Faranirina et al. (2019e) as "Least Concern" [LC] and no update is required.

Notes. – As mentioned above, *Diospyros vescoi* is one of three species in the Tetraclis group restricted to dry forests in the far north of Madagascar, along with *D. antsirananae* and *D. urschii*. Vegetatively it most closely resembles *D. antsirananae* in having relatively broad leaves, often with a rounded apex, but can be distinguished by the straight, semi-appressed, light brown trichomes 0.5 mm long on the abaxial surface of the lamina (vs. erect, curly, tangled, rusty trichomes 1 mm long in *D. antsirananae*) and by the smaller, triangular lobes of the calyx in fruit (5–7 × 6–7 mm vs. broadly triangular, 10–12 × 20–22 mm in *D. antsirananae*). *Diospyros vescoi* is a large tree species and a potential source of ebony (Lowry et al., 2024), so precise locality information has been withheld.

Additional specimens examined. – **Madagascar. Reg. DIANA [Prov. Antsiranana]:** Oronjia, 15.III.2015, ♂ bud, *Andriamiharimanana & Tombonirina 22* (MO, P, TAN); Ankarana, 6.VII.1994, fr., *Andrianantoanina 716* (BR, MO, P, US); ibid., 15.X.1997, fr., *Bardot-Vaucoulon 760* (P); Orangea [Oronjia], 28.I.2020, fl., *dos Santos 4906* (P); Ankarana, 5.II.2020, fr., *dos Santos 4998* (MO, S); Orangea [Oronjia], XII.1991, fl., *Foury s.n.* (P); Ankarana, 4.XII.2021, bud, *Karatra 437, 438, 439, 440, 441, 442, 443, 446, 447, 448* (DBEV, MO, P, TAN); ibid., fr., *Karatra 426, 444, 445, 449* (DBEV, MO, P, TAN); District d'Ambilobe, Commune de Marivorahona, Fokontany de Mahamasina, Ankarana AP., 12°56'55"S 49°07'40"E, 122 m, 4.XII.2021, fr., *Karatra 445, 449* (DBEV, MO, P, TAN); ibid., 20.XI.1996, fr., *Labat 2775* (MO, P, WAG); Ambolobozokely, 1.IV.2007, fr., *Rakotonandrasana 1159* (CNARP, MO, P, TAN); Ankarana, 10.VIII.2007, fr., *Rakotonandrasana 1176* (CNARP, MO, P, TAN); Beately, 18.XII.2005, fr., *Rakotonasolo 1035* (P); Andilanakomba, 11.XII.2007, fr., *Rakotondrajaona 423* (CNARP, MO, P, TAN); Ankarana, 16.V.2013, fr., *Rakotovao et al. 6372* (MO, P, TAN); Baie de Sakalava, 5.XI.2006, fr., *Ranaivojaona 1496* (MO, P, TAN); Sahafary, 7.XI.2006, fr., *Ranaivojaona 1554* (MO, P, TAN); [without precise locality], 3.XII.2006, fr., *Ranarivelo 1040* (CAS, MO); Oronjia, 16.VII.2020, fr., *Randriamahazomanana 253* (MO, P, TAN); ibid., 19.XI.2001, fr., *Randrianaivo 780* (MO, P, US); forêt d'Anjialava, 14.II.2006, fl., *Randrianaivo 1354* (CNARP, MO, P, TAN); Ankarana, 17.I.2014, ster., *Randrianaivo 2407* (BR, G, MO, P); ibid., 23.II.2016, fr., *Randrianaivo 2866* (MO, G, P, TAN, TEF); ibid., 7.XII.2018, fl., *Randrianaivo 3256* (DBEV, G, MO, P, TAN); Baie de Courier, 15.XII.2018, fr., *Randrianaivo 3304* (DBEV, G, MO, P, TAN); forêt de Beantely, 30.VI.2021, fr., *Randrianaivo 3754* (DBEV, G, MO, P, TAN); Ankarana, XII.2021, fr., *Randrianaivo 3899, 3900, 3901, 3902, 3903* (DBEV, MO, P, TAN); Cap d'Ambre, 14.III.2022, fl., *Randrianaivo 4022* (DBEV, MO, P, TAN); Ankirihiry, 10.XII.2005, fr., *Randrianasolo 565* (CNARP, MO, P, TAN); forêt de Belamoty, 10.XI.2006, fr., *Ratovoson 1155* (CNARP, MO, P, TAN); Orangea [Oronjia], 27.VII.2007, fr., *Ratovoson 1307* (CNARP, MO, P, TAN); Ankarana, 28.III.2020, ster., *Ravaoherinavalona 154, 155, 156, 157*

(DBEV, G, MO, P, TAN); ibid., 25.I.2017, fl., *Razafimandimbison 1786, 1788* (MO, S); Orangea [Oronjia], 24.I.2006, fl., *Razafitsalama 930* (CNARP, MO, P, TAN); Nosy Voanio, 18.III.2006, fl., *Razafitsalama 949* (CNARP, MO, P, TAN); Nosy Hara, 4.X.2007, fr., *Razafitsalama 1258* (CNARP, MO, P, TAN); Orangea [Oronjia], 12.II.2005, fl., *Schatz 4194* (CNARP, G, MO, P, TAN); forêt d'Andranotsimaka, 4.X.1952, fr., *Service Forestier 5791* (P); Ankara [Ankarana], 11.III.1954, fr., *Service Forestier 9303* (P); ibid., 24.V.1954, fr., *Service Forestier 10011* (P); ibid., 27.VII.1954, fr., *Service Forestier 10504* (P); ibid., 27.VII.1954, fl., *Service Forestier 10505* (P); Ankarana, 15.XI.1958, bud, *Service Forestier 18988* (MO, P); ibid., 5.III.1951, fr., *Service Forestier (Capuron) 3023* (MO, P, TAN); près d'Andrakaka, 27.II.1964, fl., *Service Forestier (Capuron) 23282* (MO, P); Port Leven, 1850, fl., *Vesco s.n.* (P); Ankorikihely to Orangea [Oronjia], 30.III.2007, fr., *Wen 9546* (MO, P, US). **Reg. SAVA [Prov. Antsiranana]:** forêt Binara, 3.XII.2021, ster., *Bernard 2912, 2913, 2914, 2915, 2916, 2917, 2918, 2919, 2920, 2921, 2922* (DBEV, MO, P, TAN); Ankorihika, 28.II.2010, fr., *Ludovic & Mialambo 1420* (G, K, MO, P, TAN). **Sine loco:** Bemaraha [incorrect locality, label error], VIII.1943, fr., *Herb. Jard. Bot. Tan. 6218* (P); 1946, fl., *Homolle 272* (P).

19. ***Diospyros zahamenensis*** Lowry, G.E. Schatz, A.G. Linan & H.N. Rakouth, **sp. nov.** (Fig. 6L, 12).

Holotypus: Madagascar. Reg. Alaotra-Mangoro [Prov. Toamasina]: Zahamena PN, Antoby, 18.I.2003, fr., *S. Randrianasolo 356* (2-part specimen: MO-6449168!, MO-6993806!; iso-: G [G00415844]!, P [03829511]!, TEF).

Diospyros zahamenensis Lowry, G.E. Schatz, A.G. Linan & H.N. Rakouth can be distinguished from the species it most closely resembles, D. beberonnii G.E. Schatz & Lowry, by its infructescences, at least some of which form small racemes bearing 2–4 fruits (vs. always solitary in D. beberonnii).

Tree (3–)7–19 m tall, 6–35 cm DBH. *Stem* shoot apex without numerous cataphylls prior to extension, young stems moderately densely covered with straight, appressed light brown trichomes c. 0.5 mm long, mature stems dark brown, lenticellate. *Leaves* alternate, lamina 7–12.5 × 2.6–4 cm, narrowly elliptic to narrowly oblong, subcoriaceous, initially moderately densely covered on both surfaces with same indument as young stems, glabrescent on adaxial surface, persistent on abaxial surface, base cuneate, margin slightly thickened on abaxial surface, apex acute, often with an indistinct mucron c. 1 mm long, midvein slightly impressed on adaxial surface, raised on abaxial surface, venation weakly brochidodromous, secondary veins 5–9 per side, slightly raised on both surfaces; petiole 6–8 mm long, c. 2 mm in diam., initially moderately densely covered with same indument as young stems, glabrescent. *Male flowers* borne in axillary, 4–6-flowered cymose inflorescences, the main axis (peduncle) 10–20 mm long, 1 mm in diam., densely covered with semi-appressed, straight, golden trichomes c. 0.5 mm long, pedicel c. 4–10 mm long, c. 0.5 mm in diam., densely covered with semi-appressed, straight, golden trichomes c. 0.5 mm long; calyx cupuliform, 4 × 4.5–5 mm, the 4 lobes triangular, c. 2 × 3 mm, moderately covered with semi-appressed, golden trichomes c. 0.25 mm long; corolla fleshy, cupuliform, 5–6 mm long, densely covered outside and inside with straight, appressed, golden trichomes c. 0.5 mm long, the 4–5 lobes valvate, rounded-triangular, 2–2.5 × 2–2.5 mm; stamens 16–18, subsessile, inserted in a single whorl on the corolla c. 1 mm above the base, anthers 2–2.5 mm long, apically dehiscent; pistillode discoid, c. 0.5 mm long, 1.5–2 mm in diam., densely covered with straight, erect, golden trichomes 0.25 mm long. *Female flowers* not seen. *Fruits* axillary, solitary or 2–4 in a small corymbose infructescence, primary axis to c. 10 mm, pedicel in fruit 5–7 mm long, 1–2 mm in diam., densely covered with same indument as young leaf petiole, distal abscission zone 3.8–4.2 mm in diam.; fruiting calyx accrescent, shallowly cupuliform, densely covered with persistent, light brown, appressed trichomes c. 0.5 mm long, the united portion 3–4 × c. 10 mm, the lobes 4–5, triangular to narrowly triangular, 7–8 × 5–8 mm, spreading slightly, such that the apex is not appressed to the fruit surface, margins flat along the entire length, apex acute, densely covered with persistent, light brown, appressed trichomes c. 0.5 mm long; fruit c. 4-locular, ellipsoid, 20–22 × 13–16 mm, the apex rounded, surface verrucose, moderately densely covered with persistent, appressed to semi-appressed light brown to golden colored trichomes c. 0.5 mm long. *Seeds* not seen.

Etymology. – The name chosen for this species reflects the fact that several collections, including the type, were made in or near Zahamena National Park.

Vernacular names and uses. – "Voanongo mavo" (*Randrianjanaka et al. 738*).

The wood of this species is reported to be used for manufacturing furniture (*Randrianjanaka et al. 738*).

Distribution and ecology. – *Diospyros zahamenensis* is known from only five localities in the Alaotra-Mangoro, Analamanga, and Sofia regions of eastern Madagascar (Fig. 3). It can be found growing in humid forests from 750–1000 m elevation.

Phenology. – Flowering material has been collected in January; fruiting collections have been recorded in January, September, and October.

Conservation status. – *Diospyros zahamenensis* has a geographic range in the form of an EOO of 33,350 km² (exceeding the limits for "Vulnerable" status under the criterion B1) and a minimum AOO of 32 km² (within the limits for "Endangered" status under the criterion B2). It is present in the Marotandrano reserve as well as Ankafobe, COMATSA Nord (Corridor Marojejy-Anjanaharibe Sud-Tsaratanàna partie Nord), and Zahamena protected areas, where several occurrences are situated near the reserve limits and are thus subjected to forest clearing for shifting agriculture, wildfires, illegal mining, and exploitation of trees for firewood and house

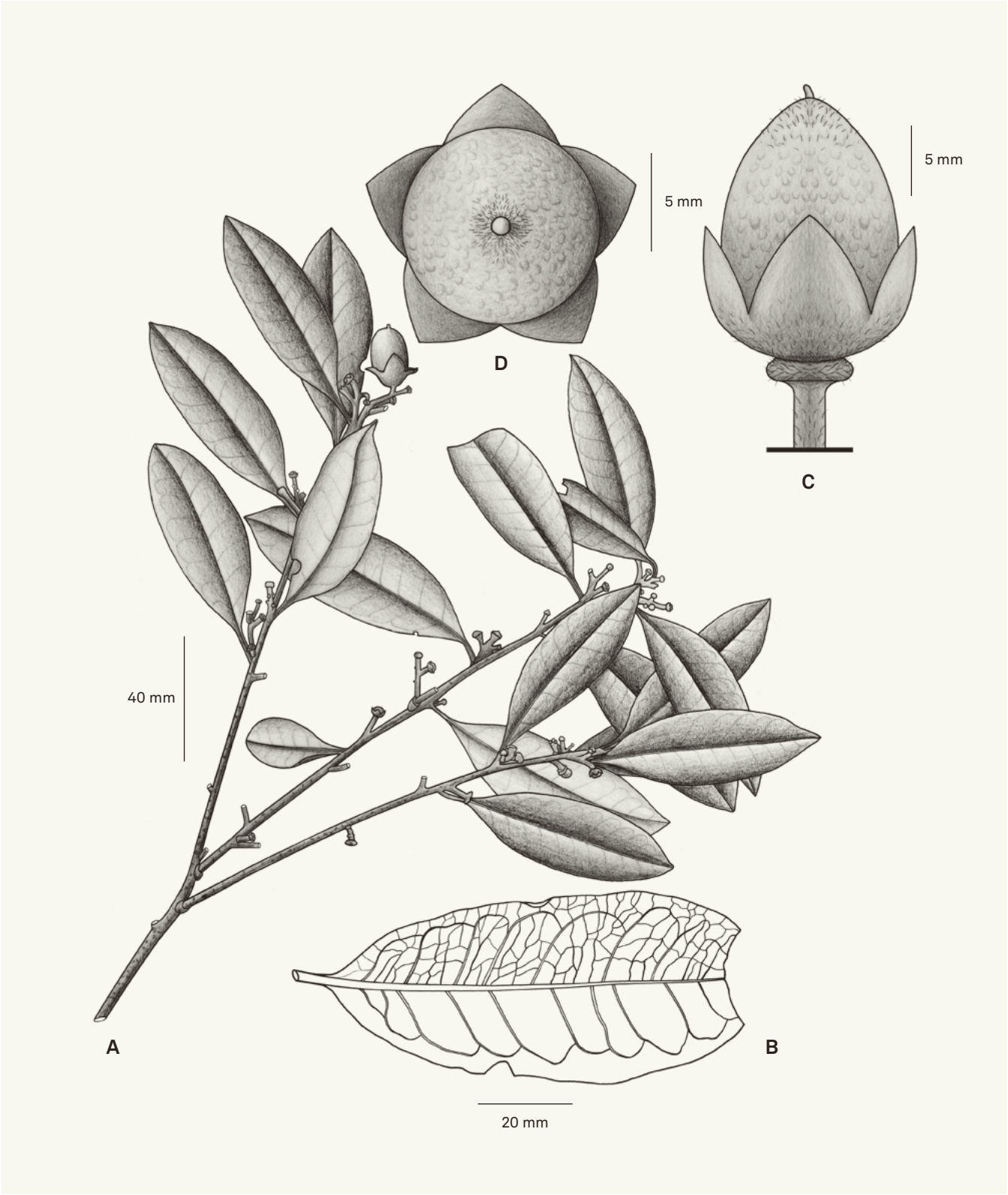

Fig. 12. – *Diospyros zahamenensis* Lowry, G.E. Schatz, A.G. Linan & H.N. Rakouth. **A.** Branch with fruit; **B.** Detail of leaf (abaxial surface); **C.** Fruit attached to pedicel; **D.** Fruit.
[**A, C, D:** *Randrianjanaka et al. 738*, P; **B:** *S. Randrianasolo 356*, P] [Drawing: Alain Jouy]

construction material, all of which are projected to result in continuing decline in quality of habitat and number of mature individuals. With respect to the most serious plausible threat, exploitation of trees for firewood and house construction material, the species exists at five locations. Therefore, *D. zahamenensis* is provisionally assessed as "Endangered" [EN B2ab(iii,v)].

Notes. – *Diospyros zahamenensis* closely resembles *D. beberonnii*, suggesting that these two species may be closely related, although in addition to the differences in infructescence structure mentioned above, their ranges are separated by over 700 km and they occur at different elevations, with *D. zahamenensis* growing at higher elevations (750–1000 m) than *D. beberonnii* (up to 500 m). *Diospyros zahamenensis* is a large tree species and a potential source of ebony (Lowry et al., 2024), so precise locality information has been withheld.

Additional specimens examined. – **Madagascar. Reg. Alaotra-Mangoro [Prov. Toamasina]:** Manakambahiny Est, 20.IX.2002, fr., *Randrianjanaka et al. 738* (CNARP, G, MO, P, TEF); ibid., 31.I.1967, fl., *Service Forestier 26285* (MO, P, TEF) **Reg. Analamanga [Prov. Antananarivo]:** Irindravato, 31.III.2022, y.fr., *Rivoharison & Ralainaorina 386* (MO, P, TAN); ibid., 17°52'39"S 47°00'39"E, 1187 m, 22.XII.2022, ster., *Rivoharison et al. 405* (MO, P, TAN). **Reg. Sofia [Prov. Mahajanga]:** Fokontany Antsiatsiaka, forêt de Riamalandy, 16°16'55"S 48°49'13"E, 780 m, 21.X.2020, fr., *Andrianarivelo et al. 87* (DBEV, G, MO, P, TAN); Fokontany Antsiatsiaka, 19.X.2020, ster., *Razakamalala 8725, 8727* (DBEV, MO, P, TAN); ibid., fr., *Razakamalala 8728* (DBEV, MO, P, TAN); vers Ambogomirahavavy, 9.X.2020, fr., *Razakamalala 9450* (MO, P, TAN).

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