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New species of *Coffea* L. (Rubiaceae) from Madagascar

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Three new species of *Coffea* from Madagascar are described: ***Coffea vohemarensis*, *C. minutiflora*** and ***C. moratii***. Full descriptions and conservation assessments are provided. *Botanical Journal of the Linnean Society*, 2003, **142,** 111–118.

ADDITIONAL KEYWORDS: Coffee – Coffeeae – Rubiaceae – Tsingy Limestone.

INTRODUCTION

This contribution represents the last in a series of papers describing new species of *Coffea* from Madagascar (Davis & Rakotonasolo 2000, 2001a, 2001b; Davis, 2001), which together form the precursor papers for a regional revision of the genus for Madagascar and the Comoros. Three new species are described here, bringing the total number of *Coffea* species in Madagascar to 53 (excluding *Coffea* subgenus *Baracoffea*). Since 2000, we have described 13 new species of *Coffea* from Madagascar. The descriptive terms and conventions used in this contribution follow those given in Davis & Rakotonasolo (2000, 2001a, 2001b). Elementary information on the morphology of *Coffea* and a brief taxonomic history of the genus in Madagascar is given in Davis & Rakotonasolo (2001b); a detailed account of *Coffea* morphology is given in Davis, Bridson & Rakotonasolo, in press).

MATERIAL AND METHODS

Herbarium material of *Coffea* was consulted at the Département de Botanique, Parc de Tsimbazaza, Antananarivo (TAN), the Muséum National d'Histoire Naturelle, Paris (P), Recherches Forestières et Piscicoles, Antananarivo (TEF), and the Royal Botanic Gardens, Kew (K). The measurements, colours and other details given in the descriptions are based mostly on herbarium specimens, but also from living plants and data derived from field notes. Cultivated material of *C. moratii* was examined at the Coffee Research Station at Kianjavato (Ministère de la Recherche Scientifique Centre National de Recherche Appliquée au Développement Rural: FOFIFA); *C. vohemarensis* was studied *in situ* by F. Rakotonasolo.

The conservation status of each species was assessed by calculating the extent of occurrence and area of occupancy using a GIS (J. Moat pers. comm.), and applying the IUCN Red List Category criteria (IUCN, 2001).

DESCRIPTIONS

Coffea vohemarensis A.P. Davis & Rakotonas. **sp. nov.**

Coffea kianjavatensi J.-F. Leroy affinis sed foliis elliptico-oblongo vel late ellipticis-oblongis, rarissime ovatis (nec unquam ellipticis nec elliptico-obovatis nec obovatis nec oblongis) semper chartaceis numquam subcoriaceis, venis lateralibus (venis secundariis) foliorum 5–7-jugis raro 7–9-jugis, stipulis ad apicem acutis (nec apiculo 0.2–0.5 longo ornato) differt.

Typus: Madagascar: Province Antsiranana: Vohemar District: south of Vohemar, Fanambana, Amboay, 190 m, 24.xi.2001 (young fr.), *Rakotonasolo* RNF 267 (holotypus TAN, isotypi K, TEF).

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TREE or SMALL TREE, *c*. 7 m high, d.b.h. *c*. 7 cm. Bark not seen. BRANCHES terete, 2.7–3.5 mm in diam., grey to light brown, smooth. BRANCHLETS ± terete, 1–1.7 mm in diam, grey to light brown, smooth, minutely and sparsely puberulous (hairs *c*. 0.05 mm long). STIPULES deltate to ovate, 1.5–2.2 × 2–2.5 mm, subcoriaceous, minutely puberulous (like the branchlets); apex acute. LEAVES: petiole (0.3–)0.5–0.7 cm long; lamina elliptic-oblong to broadly elliptic-oblong, rarely ovate (3.2–)4–7.3(–7.9) × (1.9–)2.5–4.4 cm, chartaceous; base attenuate; margins flat; apex shortly caudate, cauda 0.5–1.2 cm long; abaxial surface: midrib prominent; secondary veins prominent, 7–9 pairs, ascending at an angle of 30°–45°, ± straight, joining to form a hooped intramarginal vein, with a second intramarginal vein nearer the margin; tertiary venation prominent, ± reticulate, with many veins ± parallel to the secondary veins; higher order venation manifest to obscure, ramified; adaxial surface: venation manifest less clearly than that of the abaxial surface; domatia crypt-type, manifest, located in the axils of the secondary veins, against the midrib, orifice slit-like, *c*. 0.05–0.1 × 0.2–0.7 mm in diam., surrounding epidermis usually raised and often folded over the orifice (longitudinally), glabrous. INFLORESCENCES 1 or less frequently 2 per leaf axil, 1-flowered, unbranched, 3.5–5 mm long, elongating during fruit development, often lightly covered with a clear exudate; inflorescence axis (bearing calyculi) 2.2–3 mm long. CALYCULI 3, ± cupular, ± sessile, mostly 4-lobed, subcoriaceous, sparsely minutely puberulous (hairs 0.05–0.1 mm long), margins minutely ciliate (hairs 0.1–0.2 mm long); basal (1st) calyculus sometimes broken or fallen, 1–1.7 × 1.7–2.3 mm, stipular lobes ± very depressed ovate to nearly truncate, 0.2–0.5 × 1.4–1.6 mm, foliar lobes ± ovate to elliptic, 0.9–1.4 × 0.3–0.4 mm; middle (2nd) calyculus 1.1–1.4 × 1.5–2.2 mm, stipular lobes depressed ovate, 0.4–0.9 × 1.6–2 mm, foliar lobes ± elliptic to ovate, 0.3–0.5 × 0.2–0.3 mm; upper (3rd) calyculus often concealed by middle calyculus, 1–1.2 × 1.1–1.2 mm, truncate or margin undulate, margin with many colleters, colleters narrowly elliptic, *c*. 0.2 mm long, white; internal surfaces of calyculi sparsely covered with colleters, colleters ± conical, 0.2 mm long. FLOWERS not seen. FRUITS very imperfectly known, pedicel of immature fruit *c*. 2 mm long.

Distribution. Endemic to north-eastern Madagascar, in the Province of Antsiranana, south of Vohemar and north of Sambava (see Fig. 1).

Habitat and ecology. Humid, evergreen forest. On sand, limestone, or basement rocks. Altitude 10–200 m.

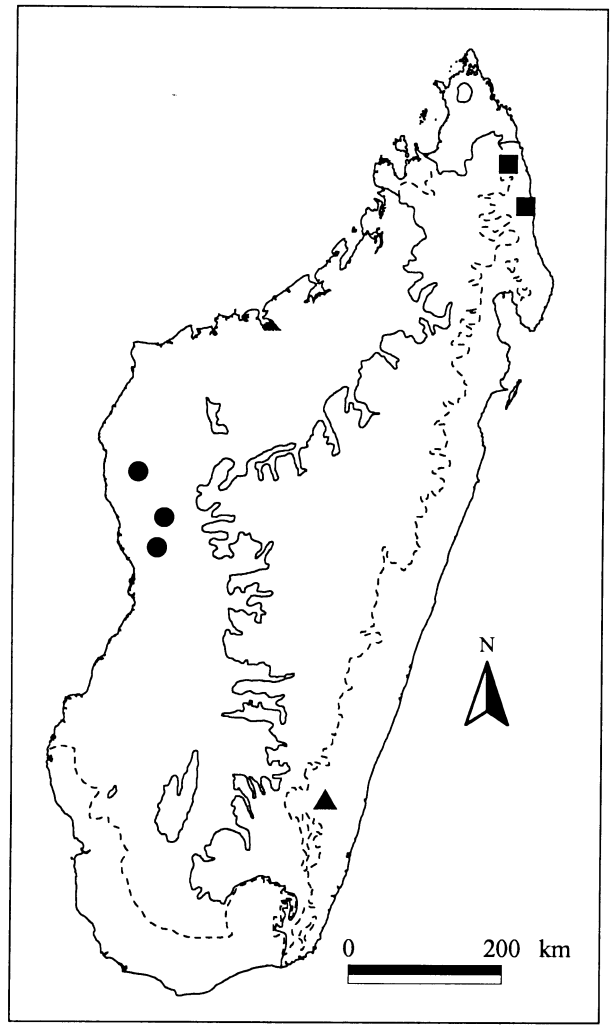

Figure 1. Distribution of ***Coffea minutiflora*** (▲), ***Coffea moratii*** (●) and ***Coffea vohemarensis*** (■). Map divided into phytogeographical domains (after Humbert, 1955), *C. minutiflora and C. vohemarensis* occur in the eastern Domain, and *C. moratii* in the western Domain.

Phenology. Imperfectly known – flowering in November.

Conservation status. Provisional IUCN Red List Category: **Endangered** (EN B1 a, b). B1 – extent of occurrence less than 5000 km^2 (*c*. 100 km^2 for *C. vohemarensis*); a – severely fragmented and possibly existing at no more than five locations (presently known from only two collections (locations)); b (i–v) – continuing decline inferred. Further fieldwork in the districts of Vohemar and Sambava is necessary before a confident conservation assessment can be made.

Other specimens examined. E MADAGSCAR: PROVINCE ANTSIRANANA: DISTRICT VOHEMAR: south of Vohemar,

Fanambana, Amboay, 190 m, 24.xi.2001 (young fr.), *Rakotonasolo* RNF 269 (K, TAN, TEF); DISTRICT SAMBAVA: N of Sambava, 11.xi.1970 (recollected at the Coffee Research Station at Kianjavato by J.-F. Leroy, date of recollection 9.x.1972 (ster.), A. 954 (K, P).

Coffea vohemarensis shares a number of morphological similarities with *C. kianjavatensis*, and therefore looks quite similar upon first inspection. For example, both species have approximately the same sized leaves, each with distinct cauda at the apex, and the inflorescences are small and very simple (sessile, unbranched, and 1-flowered). *Coffea vohemarensis* differs from *C. kianjavatensis* in several ways, but mainly in that the leaves are elliptic-oblong to broadly elliptic oblong, or rarely ovate, always chartaceous, have 7–9 secondary veins, and the tertiary venation is prominent, with a general orientation parallel to the secondary veins; the stipules are acute at the apex. The leaves of *C. kinajavatensis* are elliptic to elliptic-obovate, obovate, or rarely ± oblong, chartaceous to subcoriaceous, with usually 5–7 pairs of secondary veins (rarely 8 or 9), and the tertiary venation is weak to obscure and more or less reticulate; the stipules have an apiculum at the apex, which is usually about 0.5 mm long.

Several species of *Coffea* from northern and north-western Madagascar, namely *C. dubardii* Jum., *C. tetragona* Jum. & H.Perrier, *C. mogenetii* Dubard, and *C. heimii* J.-F. Leroy, possess tertiary venation that has a parallel orientation to the secondary veins, similar to *C. vohemarensis*. However, in the aforementioned species the tertiary veins are much more distinctly parallel and often much more strongly manifest than *C. vohemarensis*. In contrast to *C. vohemarensis*, the tertiary venation of C. kianjavetensis is weak to obscure and openly reticulate.

Coffea vohemarensis and *C. kianjavatensis* both occur in humid evergreen forest, but the ecology of each species is quite different. *Coffea vohemarensis* occurs in low altitude forest, from around sea level to 200 m, and sometimes in littoral forest, on sand or limestone. *Coffea kianjavatensis* occurs in mid-altitude forest from 300 to 600 m, but most frequently between 400 and 600 m, and is found on lateritic soils. The distribution of these two species is disjunct: *C. vohemarensis* occurs in north-east Madagascar, in the province of Antsiranana, and *C. kianjavatensis* is restricted to Mt Vatovavy and nearby hills, near Kianjavato, in the province of Fianarantsoa.

Specimen A. 951 (P!) collected from Sambava (recollected on 9.xi.1970, by J.-F. Leroy from the Coffee Research Station at Kianjavato, FOFIFA) resembles *C. vohemarensis*. It matches the new species in all its features apart from the greatly elongated calyculi. Further fieldwork is required to ascertain whether this morphological difference is part of the natural variation for this species or some other factor (e.g. an artefact of cultivation). We have provisionally determined specimen A. 951 as *C. vohemarensis* vel aff.

Coffea minutiflora A.P. Davis & Rakotonas. **sp. nov.** (Fig. 2)

Coffea vianneyi J.-F. Leroy affinis sed ramulis atque calyculis puberulis (nec glabris), foliis ad apicem breviter caudatis (nec rotundis neque brevissime caudatis), venis lateralibus (venis secundariis) ad angulum acutissimum 15°–30° tantum (nec 45°–60°) ascendentibus, floribus minoribus, corolla 3.1–5.5 mm longa (nec 6–6.5 mm longo) differt.

Typus: Madagascar: Province Fianarantsoa: Vestige de forêt orientale très dégradée au P.K. 253, de la route Ivohibe-Farafangana, près du village de Beravy, 80–100 m, 16.x.1964 (fl.), *Capuron* 23553-SF (holotypus P; isotypi BR, K, MO, P, TAN, TEF).

SMALL TREE, height unknown, d.b.h. unknown. Bark and branches unknown. BRANCHLETS ± terete, 0.5–2.5 mm in diam., light grey to medium brown or whitish, ± smooth to slightly rough, minutely but densely puberulous (hairs *c*. 0.05 mm long). STIPULES ± shallowly triangular to very shallowly triangular, 0.9–1.2 × 1.4–1.6 mm, chartaceous to subcoriaceous, puberulous like the branchlets; apex broadly acute. LEAVES: petiole (1–)1.5–4 mm long; lamina elliptic-ovate to elliptic (1.6–)2.5–5.8 × (–0.6)0.8–2.3 cm, chartaceous to subcoriaceous; base attenuate to narrowly cuneate; margins flat; apex shortly caudate, cauda 0.4–1 cm long; abaxial surface: midrib prominent; secondary veins manifest to prominent, 6 or 7 pairs, ascending at an angle of 15°–30°, ± straight, joining to form a hooped to undulating intramarginal vein; tertiary venation manifest, ± ramified to reticulate; higher order venation manifest to obscure, ± ramified to reticulate; adaxial surface: venation less clearly manifest than that of the abaxial surface; domatia crypt-type, manifest, located in the axils of the secondary veins or on the edge of the midrib, orifice circular to elliptic, 0.1–0.3 × 0.1–0.2 mm, surrounding epidermis flat, glabrous. INFLORESCENCES 1 or 2 per leaf axil, 1-flowered, unbranched, 2.5–3.1 mm long, lightly covered with a clear exudate or hardly at all; inflorescence axis (bearing calyculi) 1.5–2.5(–3.1) mm long. CALYCULI 3, ± cupular, ± sessile, 4-lobed, minutely yet densely puberulous (hairs *c*. 0.05 mm long); basal (1st) calyculus usually broken or fallen, 0.5–0.8 × 0.9–1.2 mm, stipular lobes ± depressed ovate to semi-elliptic, *c*. 0.3 × 0.6 mm, foliar lobes broadly ovate, *c*. 0.6 × 0.5 mm; middle (2nd) calyculus

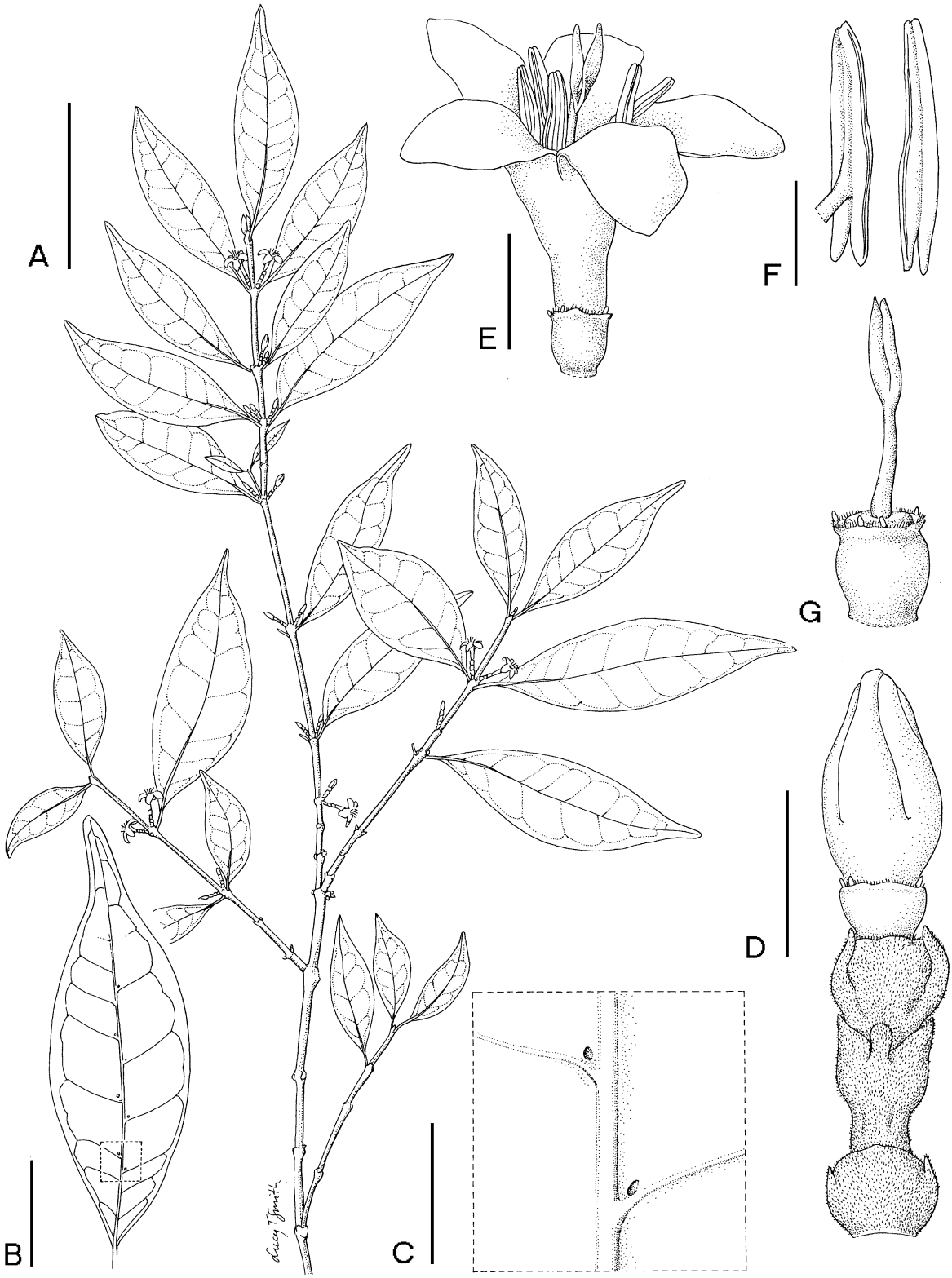

Figure 2. ***Coffea minutiflora***. A, habit; B, leaf (abaxial view); C, domatia (detail of square section from B); D, inflorescence (with three calyculi, calyx and flower bud); E, flower; F, anther (abaxial (left) and adaxial (right) view); G, calyx and style (note presence of hairs and colleters on calyx limb). A–G, *Capuron* 23553-SF. Scale bars: A = 3 cm; B = 1 cm; C–E = 2 mm; F, G = 1 mm. Drawn by Lucy T. Smith.

0.5–0.7 mm × 0.9–1.2 mm, stipular lobes depressed ovate to semi-elliptic, 0.3–0.4 × 0.7 mm, foliar lobes deltate to triangular, 0.7 × 0.4–0.5 mm; upper (3rd) calyculus 1.1–1.4 × 0.9–1.5 mm, stipular lobes semi-elliptic 0.5 × 0.5–0.7 mm; foliar lobes ± elliptic to nearly linear, 0.8–0.9 × 0.3–0.4 mm; internal surface of calyculi sparsely covered with colleters at base, colleters ± triangular, *c*. 0.1 mm long. FLOWERS 5-merous; pedicel 0.1–0.2 mm long, or flower almost sessile. Calyx (hypanthium) ± obconical (0.5–)0.7–1 × 0.8–1 mm; calyx limb undulate to very shallowly 5-lobed, margin minutely ciliate (hairs *c*. 0.05 mm long), and with 3–5 colleters; colleters narrowly cylindrical, *c*. 0.1 mm long. Corolla 3.1–5.5 × 5.2–6.5 mm; corolla tube 1–1.9(–2.6) mm long; corolla lobes 2–2.6 × 1–1.6 mm. Stamens: filaments *c*. 0.3 mm long; anthers 2.5–3.2 mm long. Ovary: disc low domed, entire. Style (2.5–)3.5–5.3 mm long; stigma lobes 0.8–1.1 mm long. FRUITS not known.

Distribution. Endemic to south-eastern Madagascar, in the Province of Fianarantsoa (see Fig. 1).

Habitat and ecology. Humid, evergreen forest. On basement rocks. Altitude 80–100 m.

Phenology. Imperfectly known – flowering in October.

Conservation status. IUCN Red List Category: **Data Deficient** (DD). Survey work in the region between Ivohibe and Farafangana, and in under-collected humid forests of SE Madagascar, is needed before the conservation status of this species can be evaluated. *Coffea minutiflora* is presently known from only a single collection.

Specimens examined. Only known from the type specimen.

In the herbaria of Paris (P) and Antananarivo (TEF) specimens of *Capuron* 23553-SF are identified as *C. vianneyi*, but closer inspection of this material shows that it represents a distinct species, which we have described here as *C. minutiflora*. *Coffea minutiflora* differs from *C. vianneyi* by having puberulous branchlets and calyculi, and a smaller corolla (3.1–5.5 × 5.2–6.5 mm; corolla tube 1–1.9(–2.6) mm long; corolla lobes 2–2.6 × 1–1.6 mm); the secondary veins ascend at an angle of 15°–30° to the midrib, and the leaf apices are shortly but distinctly caudate; in addition the calyx limb is minutely ciliate and beset with 3–5 colleters. *Coffea vianneyi* has glabrous branchlets and calyculi (although the upper calyculi are minutely papillate), and a larger corolla (6–6.5 × 7–8 mm; corolla tube 0.8–1.2 mm long; corolla lobes 4.5–5 × 1.6–1.9 mm); the secondary veins ascend at an angle of 45°–60° to the midrib, and the leaf apices are rounded or sometimes very shortly caudate; the calyx limb lacks hairs and colleters.

The flowers of this species are probably the smallest of any *Coffea* species, and thus we have chosen to name this species *C. minutiflora*. At the present time *C. minutiflora* is known from a single gathering (*Capuron* 23553-SF), collected from a small forest fragment between Ivohibe and Farafangana (province Fianarantsoa). Even though this species is presently known from only a single gathering (one collection with several duplicates), we believe that this species is undoubtedly distinct.

Coffea moratii J.-F. Leroy ex A.P. Davis & Rakotonas. **sp. nov.** (Fig. 3)

Coffea moratii J.-F. Leroy, in sched (P).

Coffea sakarahae J.-F. Leroy affinis sed foliis ellipticis vel late ellipticis vel ovatis vel late ovatis vel rarissime fere orbicularibus (nec obovatis nec oblanceolatis nec ellipticis nec anguste tantum ellipticis) (4.4–)5.5–7.7 × (2.3–)2.9–4.5(-5.3) cm (nec (1.2–)2.1–5(-5.2) × (0.5–)0.7–1.8(-2.2) cm), venis lateralibus (venis secundaris) foliorum semper 6–9-jugis (nec 4–5(6–7)-jugis), floribus 7-meris (nec 5-meris), corollis 15–18 × 13–18 mm (nec 4.5–6 × 4–6 mm), corollae tubo 7.5–9 mm longo (nec 2.5–3.5 mm) differt.

Typus: Madagascar: Province Tulear: RN 9 [Réserve Tsingy de Bemaraha], recollected from the Coffee Research Centre at Kianjavato (*Kianjavato acc. no.* A. 740), date of recollection 27.xi.1999 (fl.), *Davis & Rakotonasolo* 2326 (holotypus K; isotypi P, MO, TAN, TEF).

TREE or TREELET, *c*. 1.8–4.5 m high, d.b.h. *c*. 3–6 cm. Bark, ± smooth to slightly rough, light to dark brown. BRANCHES terete 6–10 mm, in diam., brown to light brown, smooth to fissured. BRANCHLETS ± terete (1.5–)2–4.2(–5.5) mm in diam., light brown to brown, smooth to rough, sometimes with peeling bark. STIPULES depressed ovate to shallowly triangular (1.5–)0.9–1.2 × 2–3 mm, chartaceous, glabrous; apex broadly acute to obtuse. LEAVES: petiole (2.5–)3–5 mm long; lamina elliptic to broadly elliptic, or ovate to broadly ovate, rarely almost orbicular (4.4–)5.5–7.7 × (2.3–)2.9–4.5(–5.3) cm, subcoriaceous; base attenuate, or cuneate to rounded, often slightly decurrent; margins subrevolute; apex acute to broadly acute; abaxial surface: midrib prominent; secondary veins manifest to prominent, 6–9 pairs, ascending at an angle of *c*. 45°, slightly curved and often crooked (usually where vein meets the domatia) to ± straight, joining to form a hooped intramarginal vein, with a

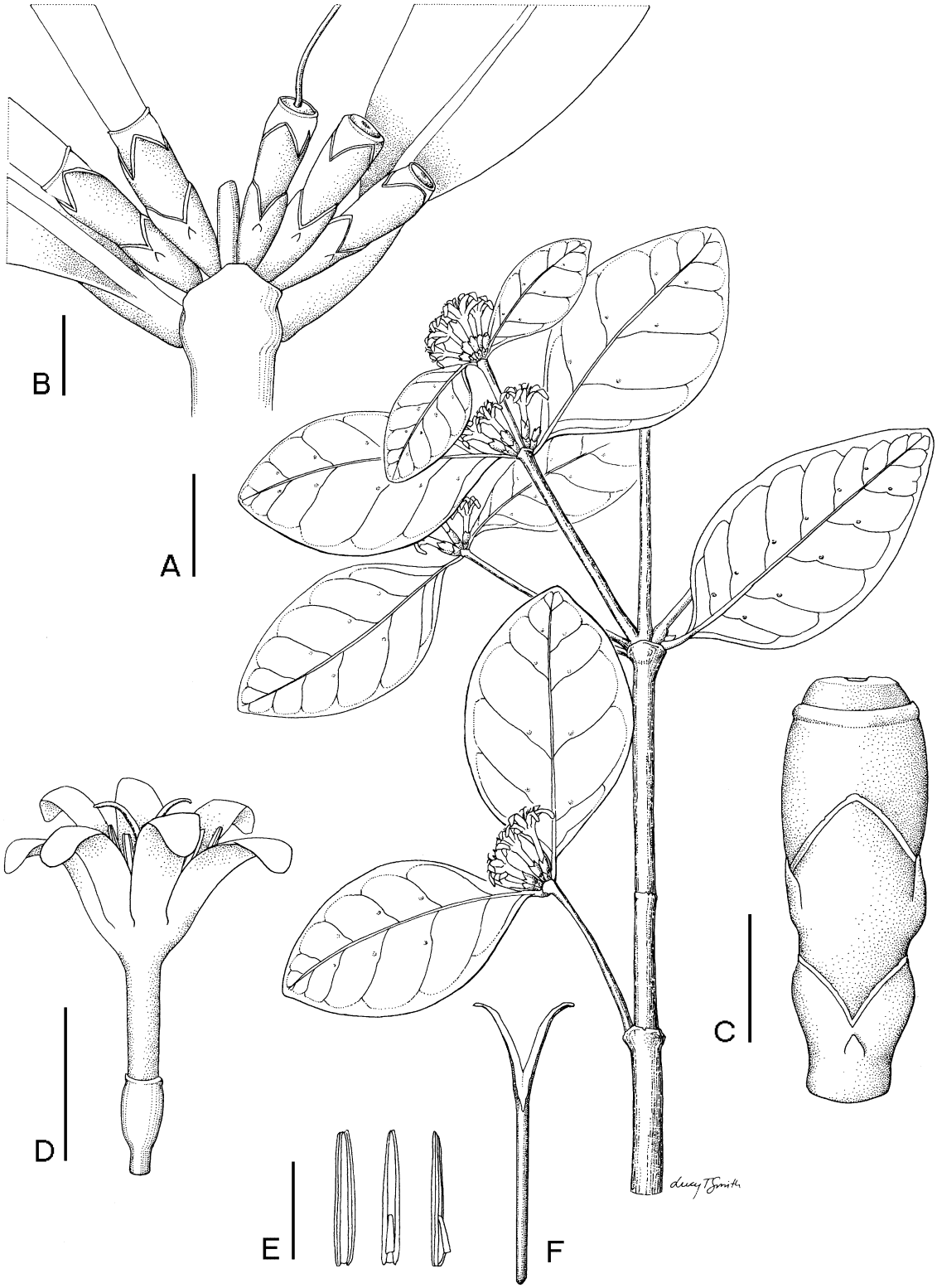

Figure 3. ***Coffea moratii***. A, habit (flowering branch); B, terminal portion of branchlet showing inflorescences; C, inflorescence, with 2 calyculi (lower calyculus fallen; corolla and style removed); D, flower; E, anthers; F, style. A–F, *Davis & Rakotonasolo* APD 2326. Scale bars: A = 2 cm; B = 4 mm; C = 3 mm; D = 1 cm; E, F = 5 mm. Drawn by Lucy T. Smith.

obvious intramarginal vein nearer the margin; tertiary venation manifest to obscure, reticulate; higher order venation manifest to obscure, ± reticulate to ramified; adaxial surface: venation manifest less clearly or more clearly than that of the abaxial surface; domatia crypt type, prominent, not located in the axils of the secondary veins but positioned (2–)3–6 mm from the midrib, along the secondary veins, the orifice ± elliptic, 0.2–0.5 × 0.2–0.3 mm, the margin and surrounding epidermis slightly raised, glabrous or with a few brown hairs (*c*. 0.2 mm long) on the inside margin, domatia more prominent on the adaxial surface, manifest as small, rounded to elliptic pustules. INFLORESCENCES axillary in the 1st or 2nd pair of leaves, 1–3 per leaf axil, 1-flowered, unbranched, 2–7.6 mm long, elongating slightly during fruit development, not or very slightly covered with a clear exudate; inflorescence axis (bearing calyculi) 2–5 mm long. CALYCULI 2 or 3 (1st calyculus absent or soon falling), ± cupular, ± sessile, 4-lobed (but foliar lobes often falling and calyculi then appearing 2-lobed), chartaceous, glabrous, margins glabrous, hyaline; basal (1st or 2nd) 2–4 × 2–2.5 mm, stipular lobes hemi-elliptic to ± deltate, 1.2–2.1 × 2 mm, foliar lobes triangular to shallowly triangular, 0.3–0.5 × 0.3–0.5 mm; upper (2nd or 3rd) calyculus 3–4.5(–5.5) × 2–2.5 mm, stipular lobes hemi-elliptic to ± deltate, 1.5–2 × 2–2.2 mm, foliar lobes absent (?fallen) or narrowly elliptic to oblanceolate, 1.8–1.9 × 0.6–0.7 mm, or the same as the foliar lobes of the lower calyculus; internal surfaces of calyculi covered with colleters, particularly in the basal $^2/_3$, colleters ± narrowly conical, 0.2–0.3 mm long. FLOWERS (5–)6–7-merous; pedicel absent or very short, 0–0.2 mm long. Calyx (hypanthium) ± obovoid, 1.9–2.5 × 2.3–2.5 mm; calyx limb truncate, with a swollen annulate rim, distinctly shorter than the disc, margin glabrous. Corolla 15–18 × 13–18 mm; corolla tube 7.5–9 mm long; corolla lobes 6–7.5 × 3.1–3.5 mm. Stamens: filaments 1–1.2 mm long; anthers 4.8–5.5 mm long. Ovary: disc prominent, low domed, entire. Style 10.1–13.6 mm long; stigma lobes 3.8–4.6 mm long. FRUITS imperfectly known, only very young fruit seen, ± ellipsoid to ellipsoid-obovoid, 5–9 × 4–8 mm. Seeds not seen.

Distribution. Endemic to western Madagascar; probably restricted to Réserve Tsingy de Bemaraha and suitable habitat nearby.

Habitat and ecology. Seasonally dry deciduous forest (containing some evergreen species). Tsingy limestone and possibly other limestone formations. Altitude 50–100 m, and possibly up to 600 m.

Phenology. Imperfectly known – flowering in October and November.

Conservation status. Provisional IUCN Red List Category: **Endangered** (EN B1a, b, and B2 a, b). B1 – total extent of occurrence less than 5000 km^2 (*c*. 1360 km^2 for *C. moratii*); B2 – area of occupancy less than 500 km^2 (*c*. 40 km^2); a – severely fragmented, and possibly existing at no more than five locations (presently known from only three collections (locations)); b (i–v) – continuing decline inferred. A provisional conservation assessment is given because the potential area of occupancy and extent of occurrence for *C. moratii* is likely to increase with further botanical survey work. The available habitat for this species in the Réserve Tsingy de Bemaraha, for example, is considerable.

Specimens examined. W MADAGSCAR: PROVINCE TULEAR: Antsalova, Bekopaka, Res. no. 9 [Réserve Tsingy de Bemaraha], x.1964 (fl.), *Morat* 876 (K, P); Reserve no. 9 d'Antsalova [Réserve Tsingy de Bemaraha], sur la route de Tsiandro, à 3 km à l'entrée de la réserve, 6.x.1968 (ster.), *Guillaumet* 2268 (K, P); dans les couloirs des Tsingy à 70 km de Maintirano sur le route de Morafenobe, xi.1968 (ster.), *Guillaumet* 2261a (K, P); RN 9 [Réserve Tsingy de Bemaraha], recollected from the Coffee Research Centre at Kianjavato (*Kianjavato acc. no.* A. 740), date of recollection 27.xi.1999 (fl.), *Davis & Rakotonasolo* 2326 (holotype K; isotypes P, MO, TAN, TEF).

Coffea moratii shares many features with *C. sakarahae*, and it seems likely that they share a close common ancestry. Both species have leaves with domatia positioned some distance from the midrib; in the majority of *Coffea* species the domatia are situated against or very close to the midrib. The inflorescences of these species are found only in the terminal portions of the shoot, in the axils of the 1st, 2nd or 3rd leaf pair (see Fig. 2), and the calyculi have very small foliar lobes. *Coffea moratii* differs from *C. sakarahae* in having distinctly larger leaves, which are usually 5.5–7.7 × 2.9–4.5 cm, elliptic to broadly elliptic, or ovate to broadly ovate, and have 6–9 pairs of secondary veins. In addition, the flowers are 6- or 7-merous (rarely 5-merous), and the corolla is 15–18 × 13–18 mm. The leaves of *C. sakarahae* are usually 2.1–5 × 0.7–1.8 cm, obovate to oblanceolate, or elliptic to narrowly elliptic, and have 4–5 or sometimes 6–7 pairs of secondary veins; the flowers are 5-merous, and the corolla is 4.5–6 × 4–6 mm.

Both *C. moratii* and *C. sakarahae* occur in seasonally dry forest, either semi-evergreen (containing deciduous species) or predominately deciduous. However, *C. moratii* is restricted to Tsingy limestone, whereas *C. sakarahae* occurs mainly on sands and basement rocks. The distribution of these two species does not overlap: *C. sakarahae* is found principally in the for-

ested areas of Site d'Internet Biologique de Zombitse (including the forest of Sakaraha) and in patches of forest within a 20-km radius of Ihosy (provinces Fianarantsoa and Tulear); *C. moratii* occurs within the Reserve Tsingy de Bemaraha, near Bekopaka, and probably in areas of similar habitat adjoining the reserve.

Coffea moratii is named after Prof. P. Morat, the director of the Laboratoire de Phanérogamie, Museum National d'Histoire Naturelle, Paris, France.

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