

A synoptic revision of the genus *Buxus* L. (Buxaceae) in Madagascar and the Comoro Islands

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ABSTRACT

A taxonomic revision of the genus *Buxus* L. (Buxaceae) in Madagascar and the Comoro Islands is presented. Reevaluation of morphological characters allow us to recognize nine species (all in Madagascar, and two also occurring in the Comoros), seven of which are described as new. Ecogeographic features of each species in relation to bioclimate and substrate geology are discussed, and a preliminary conservation assessment is calculated according to IUCN Red List criteria.

KEY WORDS

Buxus,
Buxaceae,
Madagascar,
conservation.

RÉSUMÉ

Révision synoptique du genre Buxus L. (Buxaceae) à Madagascar et aux Comores. Une révision taxonomique du genre *Buxus* L. (Buxaceae) à Madagascar et aux Comores est présentée. La réévaluation des caractères morphologiques permet de reconnaître neuf espèces (toutes à Madagascar, et deux se trouvant aussi aux Comores) dont sept nouvelles décrites ici. Les particularités écogéographiques de chaque espèce par rapport au bioclimat et au substrat géologique sont discutées, et une évaluation préliminaire pour la conservation est réalisée conformément aux critères des Listes Rouges de l'IUCN.

MOTS CLÉS

Buxus,
Buxaceae,
Madagascar,
conservation.

INTRODUCTION

The presence of the genus *Buxus* L. in Madagascar was first signaled in the late 18th century on the basis of a collection by DU PETIT

THOUARS from along the east coast of the island, which later served as the type of *B. madagascariensis* Baill. By the time of the publication of the *Flore de Madagascar* treatment of Buxaceae by PERRIER DE LA BATHIE (1952), the genus had been

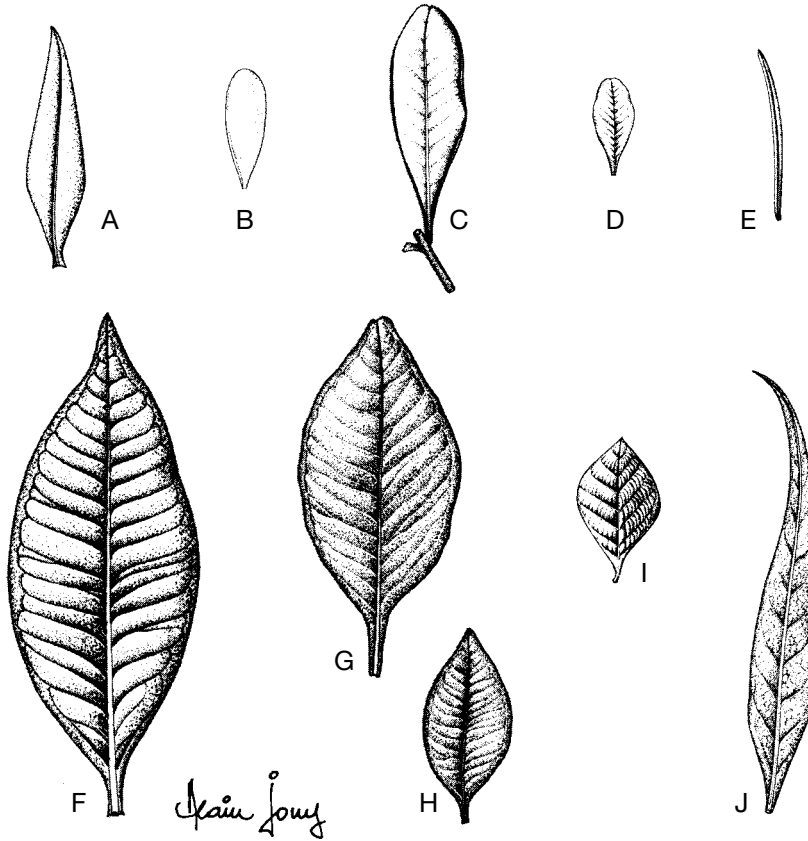


Fig. 1. — Leaves of *Buxus* species: A, *B. angustifolia*; B, *B. calcarea*; C, *B. capuronii*; D, *B. humbertii*; E, *B. itremoensis*; F, *B. macrocarpa*; G-H, *B. madagascariensis*; I, *B. monticola*; J, *B. moratii*.

recorded from throughout Madagascar, including the southern subarid bush and thicket, western deciduous forest, and subhumid to montane evergreen forest. Despite considerable variation in leaf morphology, PERRIER DE LA BATHIE encompassed all Malagasy *Buxus* within a broadly defined *B. madagascariensis*. He nevertheless recognized the variation by describing a number of infraspecific forms, the names of which are invalid, however, because he failed to associate them with Latin diagnoses. CAPURON (1960) added a second Malagasy *Buxus* with the description of the spectacularly large-fruited *B. macrocarpa* Capuron from humid forest in the northeast. In a synopsis of African Buxaceae, FRIIS (1989) briefly mentioned the invalidly

described variation within *B. madagascariensis*, and SCHATZ (2001) suggested that the “considerable variation in leaf shape of *B. madagascariensis* should be recognized at the species level”.

The following taxonomic framework proposes new species circumscriptions within Malagasy *Buxus* that correspond to the morphological variation, especially in leaf shape, size and venation (Fig. 1), and are well correlated with eco-geographic parameters, including bioclimate (CORNET 1974; SCHATZ 2000; see also LOWRY et al. 1997, 1998) and geological substrate (DU PUY & MOAT 1996). For the “Material examined” cited below under each species, abbreviations are as follows: FC = Forêt Classée, PN = Parc National, RNI = Réserve Naturelle Intégrale, RS = Réserve Spéciale, and

STF = Station Forestière. A full listing of exsiccatae for each species, with complete localities and latitude/longitude coordinates, is available through W3 TROPICOS (<http://mobot.mobot.org/W3T/Search/vast.html>). Images of selected taxa are also available on the Web at (<http://www.mobot.org/MOBOT/Madagascar/buxac.html>). Geographic coordinates indicated in square brackets were assigned *post facto* using available information on Malagasy place names and topographic maps, compiled as a gazetteer of botanical collecting localities in

Madagascar (<http://www.mobot.org/MOBOT/research/madagascar/gazetteer/>).

BUXUS L.

Sp. Pl.: 983 (1753).

TYPE. — *Buxus sempervirens* L.

Notobuxus Oliv., Hook. Icon. Pl. 14: 78 (1882). — Type: *Notobuxus natalensis* Oliv.

Key to the species of *Buxus* in Madagascar and the Comoro Islands

1. Leaves with 15-23 pairs of secondary veins, largest blades (6.5-)8-11 × (2.8-)4.2-5 cm; fruits 20-30 mm tall, mesocarp c. 5-8 mm thick 6. **B. macrocarpa**
- 1'. Leaves with no more than 10(-14) pairs of secondary veins or the venation obscure, largest blades < 7 × 2.5 cm; fruits < 10 mm tall, mesocarp < 1 mm thick 2
2. Leaves linear, 1.4-3.7 × 0.09-0.3 cm 5. **B. itremoensis**
- 2'. Leaves broader, narrowly elliptic or lanceolate to ovate, elliptic, rhombic or obovate 3
3. Leaves obovate to narrowly obovate, broadest above the middle, apex usually rounded to emarginate, occasionally obtuse 4
- 3'. Leaves lanceolate, ovate, elliptic or rhombic, broadest at or below the middle, apex acute to cuspidate (rarely rounded) 6
4. Largest leaves > 4 cm long, lower portion of the midrib on upper surface with dense, short, erect indumentum, margins distinctly revolute 3. **B. capuronii**
- 4'. Leaves < 3.5 cm long, midrib glabrous above, margins flat to weakly revolute 5
5. Leaves glaucous, especially when young, apex rounded to occasionally obtuse, venation obscure 2. **B. calcarea**
- 5'. Leaves greenish, apex rounded and usually emarginate, secondary and tertiary venation visible on upper surface 4. **B. humbertii**
6. Leaves lanceolate to narrowly elliptic or narrowly lanceolate, (2.5-)3-10 times as long as wide, apex narrowly acute to acuminate or long cuspidate 7
- 6'. Leaves ovate, elliptic or rhombic, 1.5-2.5(-3) times as long as wide, apex acute (rarely rounded) 8
7. Largest leaves 3.4-3.6 cm long, dull above, margins distinctly revolute; fruits 3.2-4 × 2.5-2.8 mm 1. **B. angustifolia**
- 7'. Largest leaves 4.2-8 cm long, shiny above, margins flat; fruits 5-7 × 4-5 mm 9. **B. moratii**
8. Plants completely glabrous; leaf blades flat, ovate to elliptic; littoral forest near sea level along E coast, mostly on sand, rarely to 600 m on Mayotte 7. **B. madagascarica**
- 8'. Plants with minute, erect indumentum at least on the upper midrib toward the base of the leaves and on young twigs, often elsewhere as well; leaf blades usually corrugated, convex above on each side of the midrib, elliptic to rhombic; montane forest, 800->2000 m 8. **B. monticola**

Clé des espèces de *Buxus* à Madagascar et aux Comores

1. Feuilles à 15-23 paires de nervures secondaires, les plus grands limbes (6,5-)8-11 × (2,8-)4,2-5 cm ; fruits de 20-30 mm de long, mésocarpe c. 5-8 mm d'épaisseur 6. **B. macrocarpa**
- 1'. Feuilles avec au maximum de 10(-14) paires de nervures secondaires ou sans nervation nette, les plus grands limbes < 7 × 2,5 cm ; fruits < 10 mm de long, mésocarpe < 1 mm d'épaisseur 2
2. Feuilles linéaires, 1,4-3,7 × 0,09-0,3 cm 5. **B. itremoensis**
- 2'. Feuilles plus larges, étroitement elliptiques ou lancéolées à ovées, elliptiques, rhombées ou obovées 3
3. Feuilles obovées à étroitement obovées, plus larges au-dessus du milieu, apex généralement arrondi à émarginé, parfois obtus 4
- 3'. Feuilles lancéolées, ovées, elliptiques ou rhombées, plus larges au milieu ou en dessous, apex aigu à cuspidé (rarement arrondi) 6

4. Feuilles les plus grandes > 4 cm de long, partie basale de la nervure médiane, sur la face supérieure portant un indument court, dense et dressé, marges distinctement révolutes 3. **B. capuronii**
- 4'. Feuilles < 3,5 cm de long, nervure médiane glabre dessus, marges non ou faiblement révolutes 5
5. Feuilles glauques, notamment à l'état jeune, apex arrondi, parfois obtus, sans nervation nette 2. **B. calcarea**
- 5'. Feuilles verdâtres, apex arrondi et le plus souvent émarginé, nervures secondaires et tertiaires visibles dessus 4. **B. humbertii**
6. Feuilles lancéolées à étroitement elliptiques ou étroitement lancéolées, (2,5-)3-10 fois plus longues que larges, apex étroitement aigu à acuminé ou longuement cuspidé 7
- 6'. Feuilles ovées, elliptiques ou rhombées, 1,5-2,5(-3) fois plus longues que larges, apex aigu (rarement arrondi) 8
7. Feuilles les plus grandes 3,4-3,6 cm de long, ternes dessus, marges distinctement révolutes ; fruits 3.2-4 × 2.5-2.8 mm 1. **B. angustifolia**
- 7'. Feuilles les plus grandes 4,2-8 cm de long, brillantes dessus, marges non révolutes ; fruits 5-7 × 4-5 mm 9. **B. moratii**
8. Plante complètement glabre; limbe aplati, ové à elliptique ; forêt littorale proche du niveau de la mer sur la côte est, principalement sur sable, rarement à 600 m à Mayotte 5. **B. madagascariensis**
- 8'. Plante à indument, dressé très court au moins sur les nervures médianes de la face supérieure, près de la base et sur les jeunes rameaux, parfois ailleurs ; limbe habituellement ridé, convexe dessus de chaque côté de la nervure médiane, elliptique à rhombé ; forêt d'altitude, 800->2000 m 7. **B. monticola**

1. *Buxus angustifolia* G.E. Schatz & Lowry, sp. nov.

Haec species a Buxo moratii foliis ut maximum 34-36 mm longis supra hebetatis margine manifeste revolutis atque fructu minore 3.2-4 × 2.5-2.8 mm distinguitur.

TYPUS. — *Rabevohitra, Ramisy, Randriahasipara & Rabenantoandro 3711, Madagascar, Prov. Toliara, direction Lakandava, forêt sur latérite, suivant torrent barrage JIRAMA, 24°58'05"S, 46°58'03"E, 1 Oct. 2000, fl. (holo-, MO!; iso-, G!, K!, P!, TEF!).*

Shrub to small tree, young stems quadrangular, each side less than 1 mm broad, the slightly winged edges 0.2 mm tall, continuous with the decussate, decurrent leaf bases; internodes 4-9(-19) mm, glabrous. Leaves chartaceous to subcoriaceous, 1.2-3.6 × 0.2-1.2 cm, narrowly elliptic to narrowly lanceolate, rarely very slightly falcate, glabrous, not glossy, apex acute to acuminate, with a rounded tip, base cuneate to more often attenuate and decurrent along stem, margins revolute, midrib distinctly raised and knife-like above, flat below except slightly raised and broadened at the base, secondary and tertiary venation obscure; lamina sessile. Inflorescences axillary; male flowers 1-3 per axil, sessile or the pedicel to 0.5 mm long, subtended by 2-3(-4) pairs of minute decussate bracts, 0.1-0.2 × 0.2 mm, ovate, concave; sepals 0.6 × 0.3-0.5 mm, ovate, flat, thin, apex rounded, margins ciliate, anthers

sessile, 1.1-1.4 × 0.3-0.6 mm; female flowers solitary on terminal portion of stems, or the central flower in a mixed inflorescence with 2 male flowers on either side, subtended by 3 pairs of slightly keeled, narrowly triangular to acicular bracts, 1 × 0.2 mm, apex acute; sepals absent; styles 1.4-2 mm long, strongly recurved. Fruits 3.2-4 × 2.5-2.8 mm, rectangular-ellipsoid, styler remnants 2.5-3 mm; seeds 3 × 1.5 mm. — Fig. 2.

Buxus angustifolia is a shrub to small tree known from only two localities in humid evergreen forest on laterite in southeastern Madagascar (Fig. 3). It can be distinguished from *B. madagascariensis* by its narrowly elliptic to narrowly lanceolate, dull leaves with virtually no evident secondary or tertiary venation, and from *B. moratii* by its smaller leaves with revolute margins and smaller fruits.

VERNACULAR NAME. — Masiranandjoa, Retsiraka, Soazanahary.

CONSERVATION STATUS. — With an Area of Occupancy of perhaps only 200 km² and only two known localities, both outside the current protected areas network, *B. angustifolia* is assigned a preliminary status of Endangered (EN B2ab).

PARATYPES. — MADAGASCAR, *Prov Toliara: Humbert 20585*, vallée de la Manampanihy (Sud-Est) aux environs d'Amipasimena, restes de forêt ombrophile et savoka sur argiles latéritiques et granite (au sud du



Fig. 2. — *Buxus angustifolia*: A, fruiting branch; B, leaf, adaxial surface; C, leaf, abaxial surface. (Rabevohitra et al. 3711).

fleuve), [24°24'S, 47°11'E], 20-100 m, 18-23 Mar. 1947, fr. (MO, P).

2. *Buxus calcarea* G.E. Schatz & Lowry, sp. nov.

Buxus madagascariensis subsp. *xerophila* H. Perrier, Fl. Madagascar 113: 4-5 (1952), nomen inval., non rite publ. sine Latin, pro parte "*fa. calcicola* H. Perrier"; *syn. nov.*

Haec species lamina foliari plerumque supra medium latiore ad congeneros madagascarienses nonnullos accedit, sed ab eis foliis minoribus (minus quam 35 mm longis) rigidissimis venatione ut videtur carentibus juventute glaucis distinguitur.

TYPUS. — *Service Forestier (Capuron) 11870* [= *H. Humbert & R. Capuron 29315*], Madagascar, Prov. Toliara, Sud-Ouest: bush (sur calcaire) sur les falaises des environs de Lavanono [falaise côtière nord-

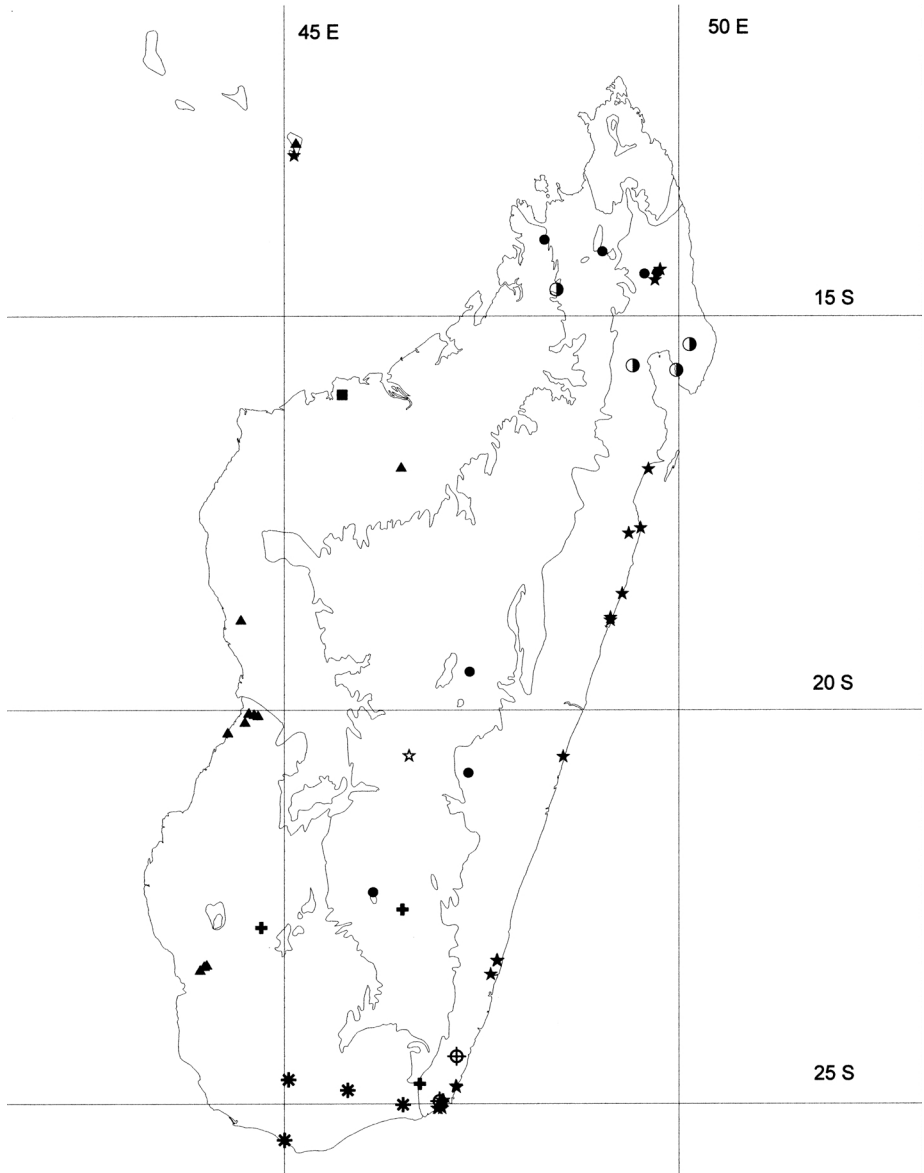


Fig. 3. — Distributions of *Buxus*, mapped on the bioclimatic zones of Madagascar (after CORNET 1974; see SCHATZ 2000). *B. angustifolia* (°), *B. calcarea* (*), *B. capuronii* (■), *B. humbertii* (+), *B. itremoensis* (☆), *B. macrocarpa* (◐), *B. madagascarica* (★), *B. monticola* (●), *B. moratii* (▲).

ouest du Cap Sainte-Marie vers Lavanono], [25°28'S, 45°00'E], 1-150 m, 8 Mar. 1955, fr. (holo-, P!; iso-, K!, MO!, P!, TEF!).

Shrubs to small trees to 4-5 m, young stems 1 mm diam., glaucous with short, erect tri-

chomes, internodes 7-11 mm. Leaves very stiff and thick coriaceous, glaucous when young, 0.7-3.2 × 0.3-1.1 cm, oblanceolate to obovate or sometimes narrowly elliptic, usually broader above the middle, apex rounded to obtuse or rarely acute, base cuneate to attenuate, midrib



Fig. 4. — *Buxus calcarea*: A, fruiting branch; B, leaf, adaxial surface; C, leaf, abaxial surface. (Service Forestier 11870).

invisible above, evident and slightly raised towards the base below, secondary venation absent; petioles 1-2 mm long. Flowers solitary, axillary; male flowers subtended by 8-12, slightly keeled, minute bracts; sepals 4, 0.6-1 × 1-1.2 mm, broadly ovate, apex rounded; anthers 4, sessile, 1.5 × 1 mm; female flowers subtended by 8 slightly keeled, minute bracts; sepals 4, 1.2-1.6 × 0.9-1.8 mm, broadly ovate, keeled, apex obtuse to acute, styles 3, 3-4 mm long, apex strongly recurved, stigma borne along inside of upper 2/3. Fruits 6-8.5 × 5 mm, ellipsoid, stylar remnants 2 mm; seeds 5.5 × 3 mm. — Fig. 4.

Buxus calcarea is known from subarid deciduous thicket on tertiary limestone in southwestern Madagascar, from the Mahafaly plateau to Angavo east of Antanimora (Fig. 3). Among the species with leaf blades usually broader above the middle, *B. calcarea* can be distinguished from *B. capuronii* and *B. humberitii* by its small, very stiff coriaceous leaves lacking any visible venation, which are glaucous when young.

CONSERVATION STATUS. — *Buxus calcarea* is known from only 4 localities, and has not been collected since 1963. With an Extent of Occurrence of c. 3,650 km², an Area of Occupancy of perhaps only 400 km², and only 4 sub-populations, *B. calcarea* is assigned a preliminary status of Endangered (EN B1ab2ab).

PARATYPES. — MADAGASCAR, *Prov. Toliara: Perrier de la Bathie* 5989, plateau Mahafaly (Menarandra), [24°42'S, 45°03'E], June 1910, fl. (P, 2 sheets); *Service Forestier (Capuron)* 8485, Sud-Ouest: bush, à l'est du Mandrare, sur la route d'Ambovombe à Ft. Dauphin, [25°01'S, 45°30'E], 22 Sep. 1953, fl. (P, TEF); *Service Forestier (Capuron)* 22484, Sud: crête du massif de l'Angavo à l'est d'Antanimora, [24°50'S, 45°48'E], 500 m, 23 Jan. 1963, fr. (MO, P, TEF).

3. *Buxus capuronii* G.E. Schatz & Lowry, **sp. nov.**

Haec species lamina foliari plerumque supra medium latiore ad congeneros madagascarienses nonnullos accedit, sed ab eis foliis majoribus (maximo plus quam 40 mm longo) supra secus costam rubellam trichomatibus albis erectis brevibus obrectis distinguitur.

TYPUS. — *Service Forestier (Capuron)* 24212, Madagascar, *Prov. Mahajanga, Ouest (Ambongo): forêt de Tsiombikibo [FC], à l'ouest de Mitsinjo, [16°00'S, 45°44'E], 19 Nov. 1965, fl. (holo-, P!; iso-, BR!, Cl, G!, K!, MO!, P(2)!, PRE!, TEF!, US!, WAG!)*.

Small tree, stems 1 mm diam., reddish, prominently ridged, covered with sparse, short, erect, white trichomes, internodes 5-11 mm. Leaves coriaceous, 3-5.1 × 0.6-1.8 cm, narrowly obovate to obovate, apex rounded to obtuse, base cuneate to attenuate, midrib raised and rounded above, 0.2 mm broad at apex broadening to 0.9 mm broad at base, reddish, with short, erect, white trichomes becoming dense toward the base, slightly raised below, secondary veins 12-16 per side, barely visible on young leaves; petioles 1-2 mm long. Flowers axillary; male flowers solitary or 3 per axil, subtended by 8 or 12, slightly keeled, minute bracts; sepals 4, 0.8 × 0.6-0.9 mm, broadly ovate, the apex rounded to acute; anthers 4, sessile, 1.6-1.7 × 0.7-0.8 mm; female flowers solitary, or 2-3 per axil, or the central flower in bisexual inflorescences, subtended by 12 strongly keeled, minute bracts; sepals 4, 1.5 × 1.6 mm, triangular, strongly keeled, the apex acute, styles 3, exserted only 0.5 mm above sepals. Fruits unknown. — Fig. 5.

Buxus capuronii is known only from the type collection, gathered by CAPURON in November, 1965, at the dry deciduous forêt de Tsiombikibo to the west of Mitsinjo in the Ambongo region (Fig. 3). Among the species with leaf blades broader above the middle, *B. capuronii* can be distinguished from *B. calcarea* and *B. humberitii* by its larger leaves with the midrib above bearing short, erect, white trichomes.

ETYMOLOGY. — This species is named in honor of René CAPURON, who contributed so much to our knowledge of Madagascar's woody flora.

CONSERVATION STATUS. — Because *Buxus capuronii* is known only from a single historical collection, the available data are insufficient to assess its conservation status. It must therefore be regarded as Data Deficient (DD). Tsiombikibo currently retains the status of a Forêt Classée, and thus there is hope that *B. capuronii* still persists there, or in nearby Baie de Baly PN.

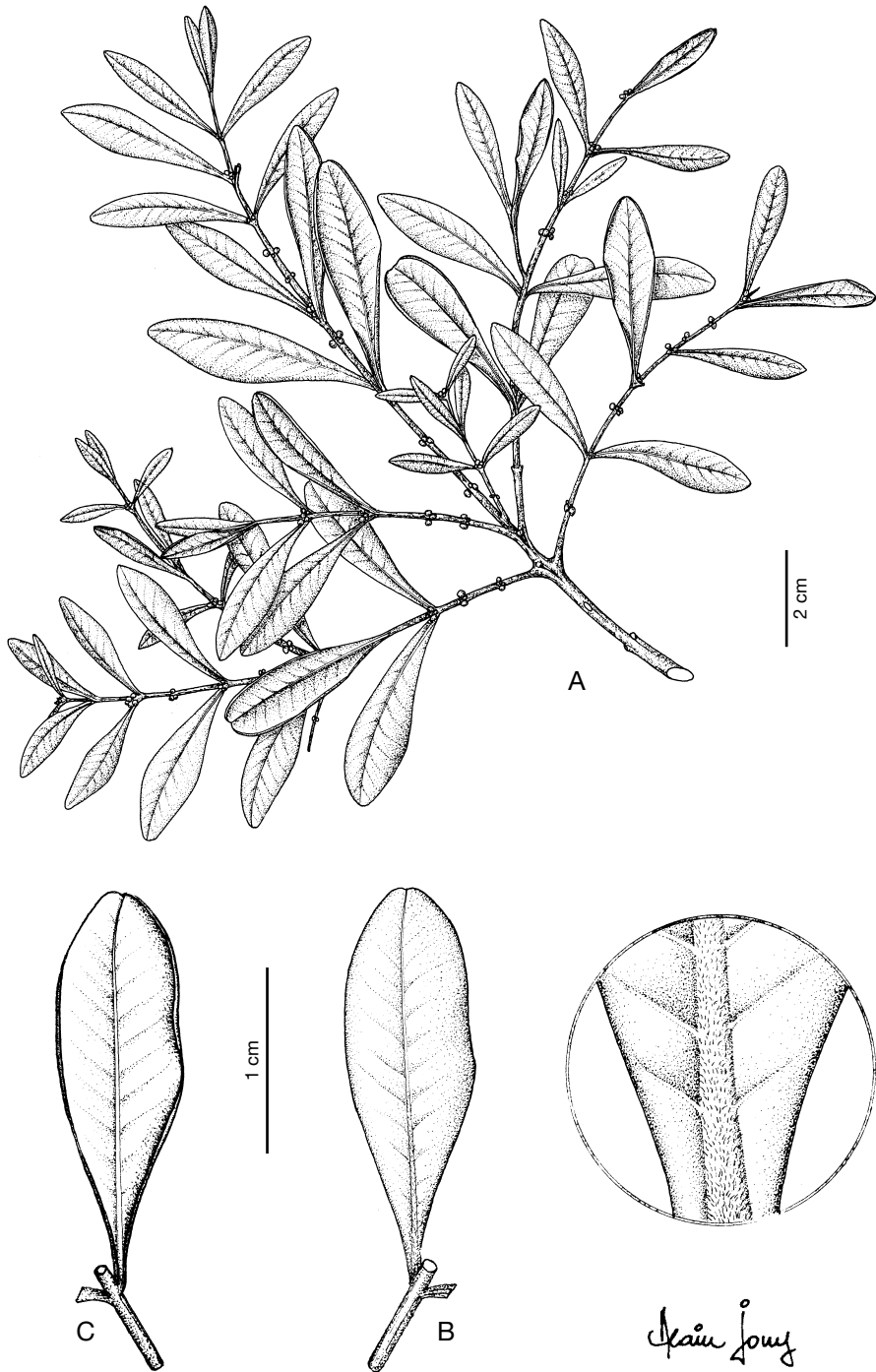


Fig. 5. — *Buxus capuronii*: A, flowering branch; B, leaf, adaxial surface; C, leaf, abaxial surface. (Service Forestier 24212).

4. *Buxus humbertii* G.E. Schatz & Lowry, sp. nov.

Buxus madagascariensis subsp. *xerophila* H. Perrier, Fl. Madagascar 113: 4-5 (1952), nomen inval., non rite publ. sine Latin, pro parte "*fa. silicicola* H. Perrier"; *syn. nov.*

Haec species lamina foliari plerumque supra medium latiore ad congeneros madagascarienses nonnullos accedit, sed ab eis foliis minoribus (minus quam 35 mm longis) glabris venatione secundaria tertiariaeque supra manifesta apice plerumque emarginatis distinguitur.

TYPUS. — *Humbert 13695*, Madagascar, Prov. Toliara, bassin de réception de la Mananara, affluent du Mandrare, pentes occidentales des montagnes entre l'Andohahela et l'Elakelaka entre Ampahiso et Mahamavo (gneiss), vers 700 m, [24°45'S, 46°43'E], Jan.-Feb. 1934, fr. (holo-, P!; iso-, MO!, P!).

Shrubs to small trees, young stems < 1 mm diam., glabrous, internodes 4-9(-20) mm. Leaves coriaceous, glabrous, greenish and somewhat glossy, 0.8-2.2 × 0.3-1 cm, oblanceolate to obovate, slightly convex, apex rounded and often emarginate, base attenuate and decurrent, midrib flat to slightly impressed along lower half above, slightly raised below, dense secondary and tertiary venation evident and slightly raised above; leaves subsessile, petioles < 1 mm long. Flowers unknown, axillary; sepals of female flowers in fruit 2 × 1.5-1.8 mm, triangular, the apex acute to obtuse. Fruits 6-7 × 4.5-5 mm, ellipsoid, the stylar remnants 1 mm long; seeds 3-3.5 × 2 mm. — Fig. 6.

Buxus humbertii is known from three disjunct areas of dry to subarid deciduous thicket and forest in southern Madagascar, possibly associated with siliceous soils on gneiss (Fig. 3): the western slopes of Andohahela PN in the upper Mananara river basin; the Menarahaka river valley east of Ihosy; and Zombitsy PN near Sakaraha, where it was last collected in 1972. Among the species with leaf blades usually broader above the middle, *B. humbertii* can be distinguished from *B. calcarea* and *B. capuronii* by its small, somewhat convex leaves with distinct secondary and tertiary venation visible on

the upper surface and with a usually emarginate apex.

ETYMOLOGY. — The species epithet honors Prof. Henri HUMBERT, who conducted extensive field work in Madagascar over five decades, and who contributed greatly to our understanding of the Malagasy flora and vegetation.

CONSERVATION STATUS. — *Buxus humbertii* is known from only 3 localities, and has an Area of Occupancy of approximately 300 km² within an Extent of Occurrence of c. 24,765 km². Thus, despite the fact that it may persist at two protected areas (Zombitsy PN and Andohahela PN), *B. humbertii* is assigned a preliminary status of Endangered (EN B2ab).

PARATYPES. — MADAGASCAR, Prov. Toliara: *Debray 1913*, forêt du Zombitsy-Sakaraha, [Zombitsy PN], [22°46'S, 44°42'30"E], 30 Nov. 1972, st. (MO, P); *Guillaumet 2438*, forêt du Zombitsy-Sakaraha, [Zombitsy PN], [22°46'S, 44°42'30"E], Apr. 1969, st. (P, TAN); *Service Forestier (Capuron) 20229*, Ouest: forêt du Zombitsy, à l'est de Sakaraha, [Zombitsy PN], [22°46'S, 44°42'30"E], 3-5 Apr. 1961, fr. (K, MO, P, TEF); *Service Forestier 96-R-10*, forêt de Menarahaka, Dist. d'Ihosy, [22°32'S, 46°29'50"E], Dec. 1951, st. (MO, P, TEF); *Service Forestier 46-R-239*, Menarahaka, Ihosy, [22°32'S, 46°29'50"E], 7 Feb. 1954, st. (P, TEF); *Service Forestier 207-R-239*, forêt de Menarahaka, Dist. d'Ihosy, [22°32'S, 46°29'50"E], 25 Mar. 1956, st. (P, TEF).

5. *Buxus itremoensis* G.E. Schatz & Lowry, sp. nov.

Haec species ab omnibus congeneris madagascariensis foliis maturis linearibus distinguitur.

TYPUS. — *Labat, Du Puy & Andriantiana 2441*, Madagascar, Prov. Fianarantsoa, Ambatofinandrahana, Itremo, juste à l'est du col d'Itremo, 20°34'13"S, 46°35'08"E, 1560 m, 26 Nov. 1993, fl. fr. (holo-, P!; iso-, K!, MO!, TAN!, TEF!, WAG!).

Rheophytic shrub 2 m tall growing amongst rocks in streambed, completely glabrous. Stems 0.6 mm diam, distinctly 4-angled, internodes 4-10 mm. Leaves coriaceous, 1.4-3.7 × 0.09-0.3 cm, linear, sometimes slightly falcate, apex acute to acuminate, base attenuate and decurrent along stem, midrib flat to slightly raised

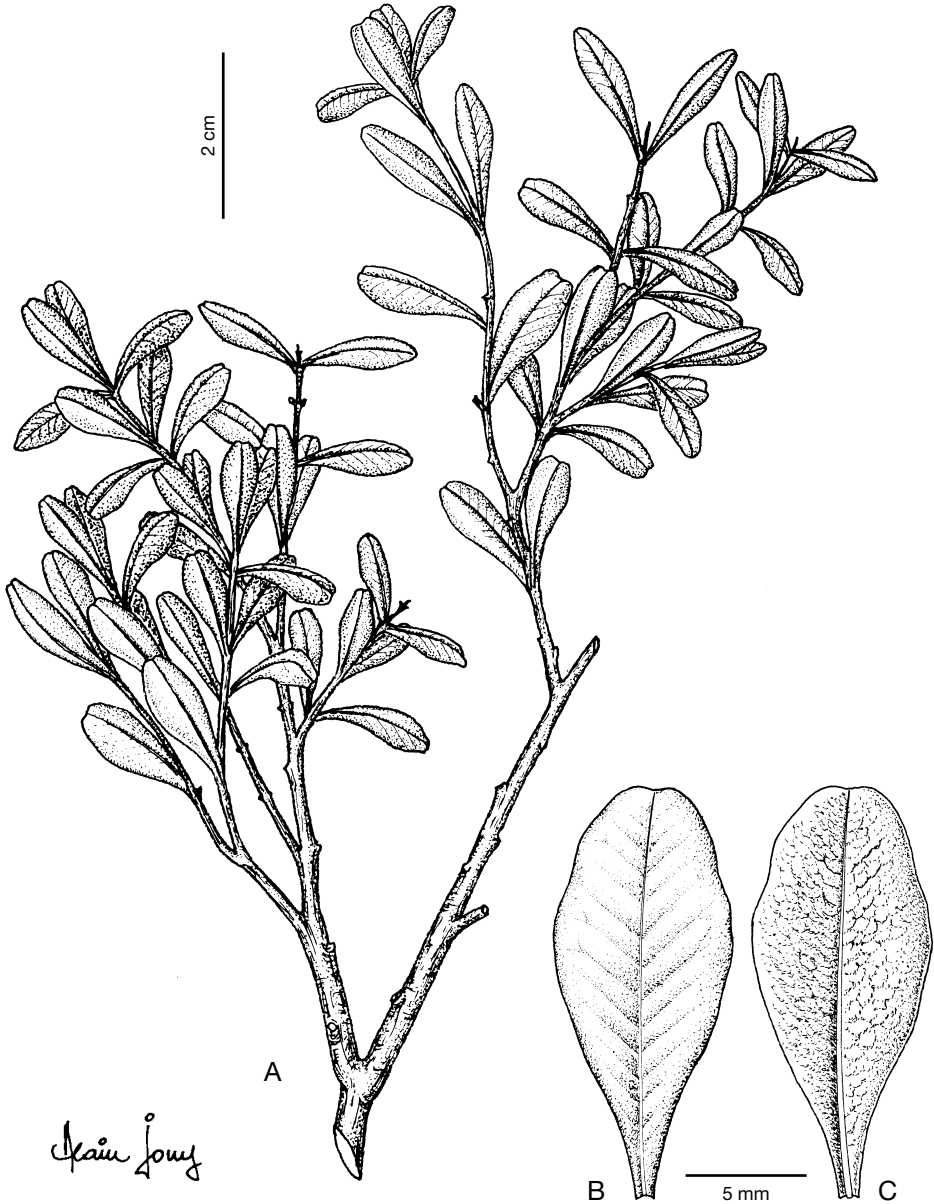


Fig. 6. — *Buxus humbertii*: A, flowering branch; B, leaf, adaxial surface; C, leaf, abaxial surface. (Humbert 13695).

above, raised below, secondary venation absent; leaves sessile, petioles to 0.4 mm. Flowers solitary, axillary, subtended by several minute bracts; male flowers with 4 minute sepals less than 0.5 mm long, anthers 4, sessile, fused at their base, 1 ×

0.4 mm; female flowers with 4 minute sepals less than 0.5 mm long, styles 3, sessile, 3 mm long, the apex strongly recurved, stigma borne along inside of upper 2/3. Fruits 3-3.5 × 2-2.5 mm, ellipsoid, the styler remnants 1.6 mm long. — Fig. 7.

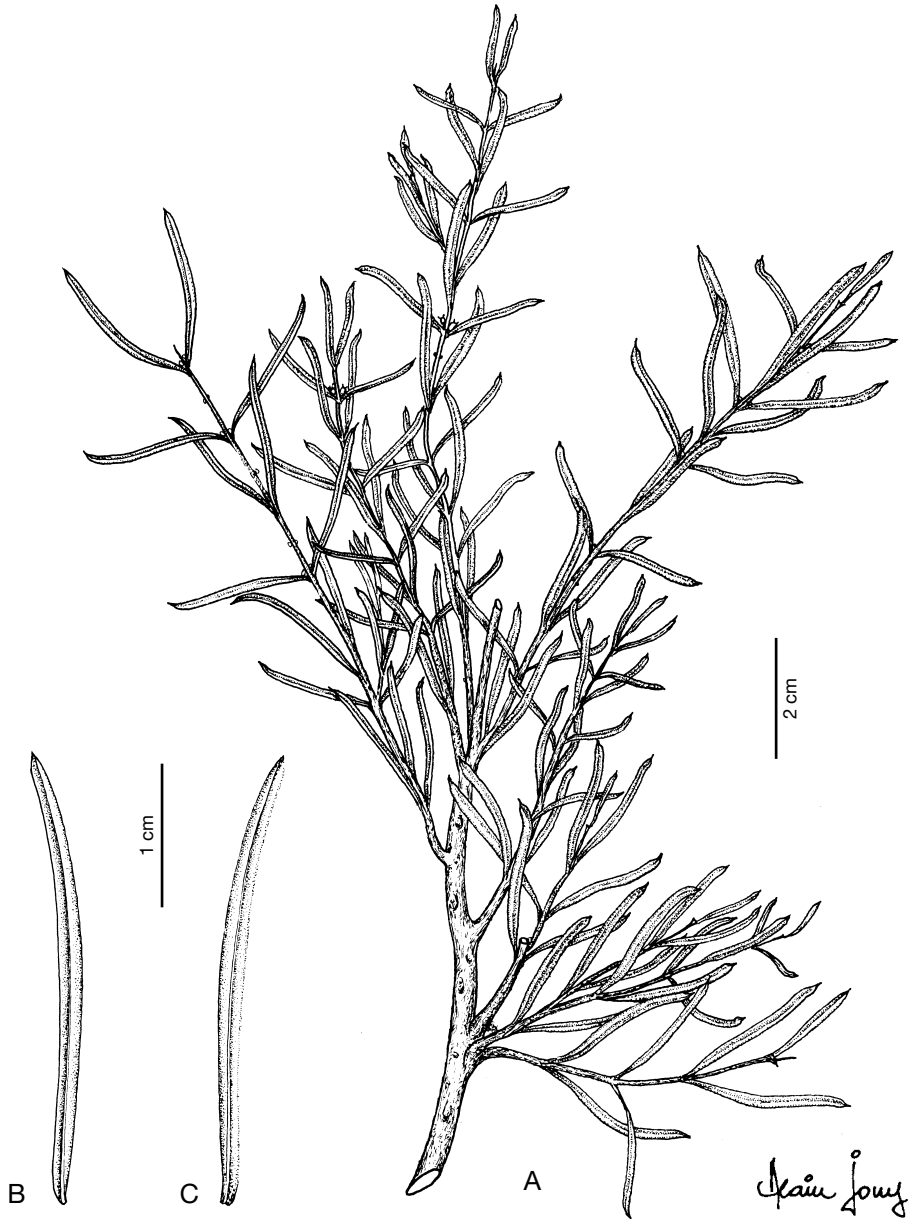


Fig. 7. — *Buxus itremoensis*: A, flowering and fruiting branch; B, leaf, adaxial surface; C, leaf, abaxial surface. (Labat et al. 2441).

Buxus itremoensis is a rheophytic shrub known only from the Itremo massif (Fig. 3). It can be easily distinguished from all other Malagasy *Buxus* species by its linear, slightly falcate leaves. Both *Buxus madagascariensis* and *B. monticola* also

exhibit linear leaves during the juvenile seedling stage, as illustrated by PERRIER DE LA BÂTHIE (1952) in the *Flore de Madagascar* (undoubtedly based upon Perrier de la Bâthie 13275 for *B. madagascariensis*). Thus, *Buxus itremoensis* possi-

bly represents a case of paedomorphism, with retention of juvenile leaves into the adult reproductive stage.

CONSERVATION STATUS. — With only a single sub-population outside the current protected areas network, an Extent of Occurrence less than 100 km² and an Area of Occupancy less than 10 km², *B. itremoensis* should be considered Critically Endangered (CR B1ab2ab). It joins numerous other plant species restricted to the Itremo massif, which is among the very highest priority areas for plant conservation in Madagascar.

PARATYPES. — MADAGASCAR, *Prov. Fianarantsoa*: *Humbert 30033*, montagnes à l'ouest d'Itremo, bois des pentes occidentales sur gneiss et quartzites, [20°34'S, 46°34'E], 1500-1700 m, 17-22 Jan. And 18-22 Apr. 1955, fr. (CAS, G, K, MO, P (3 sheets), WAG); *Lowry, Schatz, Andriamihajarivo, Hong-Wa, Rapanarivo & Rabarison 5822*, Itremo massif, W of Ambatofinandrahana along road to Col d'Itremo, just below bridge over Ambalorangolana river, wet creek bed, 20°34'40"S, 46°35'11"E, 1540 m, 9 Nov. 2002, fl. (CAS, G, K, MO, P, TEF, WAG); *Randrianaivo, Birkinshaw, Rakotomamonjy, Andriatiana, Randrianasolo & Rasolomanana 154*, Itremo, 20°34'S, 46°34'E, 1630-1770 m, 6 Apr. 1998, fr. (MO, P, TAN); *Schatz, Razafindrakoto, Andrianjafy & Rabenantoandro 3980*, Itremo, 20°34'21"S, 46°34'54"E, 1580 m, 11 Mar. 2000, fr. (MO, P, TEF); *Service Forestier (Capuron) 11556*, Mont Ambatomenaloha, W d'Itremo, restes de forêts dans les thelwegs humides, [20°34'S, 46°34'E], 18 Jan. 1955, fl. (G, K, MO, P (2 sheets), TEF); *Service Forestier (Capuron) 29041*, berges et rochers encombrant le lit de l'Ambatorangotana dans le montée au col de l'Itremo, [20°34'S, 46°34'E], 1600 m, 21 Feb. 1970, fr. (MO, P (2 sheets), TEF); *van der Werff & McPherson 13585*, massif d'Itremo, 20°37'S, 46°35'E, 1500 m, 27 Oct. 1994, fl., fr. (MO, TAN).

6. *Buxus macrocarpa* Capuron

Notul. Syst. (Paris) 16: 80 (1960). — Type: *Service Forestier (Capuron) 9093*, Madagascar, *Prov. Toamasina*, Est: crête entre les bassins de la Minongo et de Vohilava (bassin de la Rantabe), au nord-ouest de Sahajinja, c. 800 m, Mar. 1954, fr. (holo-, P!, iso-, MO!, P!, TEF!).

Buxus macrocarpa is a small to medium sized tree to 15 m known from humid forest in the

region of the Bay of Antongil and the valley of the Beandrona river east of Ambanja in the Sambirano region (Fig. 3). It is easily distinguished from all other Malagasy *Buxus* species by its large leaves with 15-23 pairs of secondary veins and spectacularly large fruit (20-30 mm tall – undoubtedly the largest in the genus) with a 5-6 mm thick, fleshy endocarp.

CONSERVATION STATUS. — With an Extent of Occurrence of c. 2,980 km², an Area of Occupancy of 300 km², and only 4 sub-populations, *Buxus macrocarpa* is assigned a preliminary status of Endangered (EN B1ab2ab). Recent collections from Masoala PN provide hope for its long-term persistence.

MATERIAL EXAMINED. — MADAGASCAR, *Prov. Antsiranana*: *Service Forestier (Capuron) 18920*, Beandrona, Ambanja; *Service Forestier (Rabevohitra) 34875*, Ambatoledama. *Prov. Toamasina*: *Rabe 82, 83*, Ambodiforaha, Masoala PN.

7. *Buxus madagascariensis* Baill.

Mon. Buxac. 65. 1859. — *Buxella madagascariensis* (Baill.) van Tiegh., Ann. Sci. Nat. Bot. VIII, 5: 326 (1897). — *Notobuxus madagascariensis* (Baill.) Phillips, J. S. African Bot. 9: 140 (1943). — Type: *du Petit Thouars s.n.*, Madagascar, without precise locality, fl. (holo-, P!; iso-, K!, P!).

Buxus madagascariensis as here circumscribed is a shrub to small tree that occurs at low elevation along the east coast of Madagascar, mostly in littoral forest on sand, but occasionally on lateritic substrate, and rarely at higher elevations (Marojeje PN) on weathered quartzite sands, with a disjunct population on the upper slopes and summit (400-594 m) of Mt. Choungui on Mayotte in the Comoro archipelago (Fig. 3). *Buxus madagascariensis* can be distinguished from *B. monticola* (with which it often shares elliptic, glossy leaves with revolute margins) by its completely glabrous stems and leaves. It differs from *B. angustifolia* in having ovate to elliptic leaves that are shiny on the upper surface and have evident secondary and tertiary venation. Leaf size varies considerably in *B. madagascariensis*,

from over 6 cm in length in the humid littoral forest along the east coast to less than 2 cm in length in drier littoral forest southwest of Ft. Dauphin at Vinanibe.

VERNACULAR NAMES. — Madagascar: Rami-densinala; Mayotte: Hazourountroun, Kani kaly.

CONSERVATION STATUS. — With an Extent of Occurrence of c. 53,850 km² and an Area of Occupancy of 1,500 km², *Buxus madagascari-ca* is known from 15 localities, and thus falls just short of the criteria necessary to confer threatened status. However, given the highly fragmented nature and continuing loss of littoral forest along the east coast of Madagascar, it is likely that *B. mada-gascarica* will qualify in the near future, and thus is here assigned a preliminary status of Near Threatened (NT).

MATERIAL EXAMINED. — MADAGASCAR, *Prov. Antsiranana*: Humbert 23438, Marojejy PN; Razafimandimbison 266, Marojejy PN. *Prov. Fianarantsoa*: Bosser 18753, Vangaindrano; McPherson 18322, Mahabo; Rabevohitra 3776 (=Service Forestier 35366), 3799 (=Service Forestier 35389), Mahabo; Service Forestier 14675, Nosy Varika. *Prov. Toamasina*: Cremers 2315, Foulpointe; Debray 1824, W of Foulpointe; Lowry 3980, Ambila-Lemaitso STF; Perrier de la Bâthie 13275, Tampina; Rakotozafy 1140, Analabe-Foulpointe; Service Forestier 18060, Ambila-Lemaitso STF; Service Forestier 22088, W of Foulpointe, 23804, Sahavolamenabe; Service Forestier 29899, Ambila-Lemaitso STF; Service Forestier 34156, 34232, Foulpointe. *Prov. Toliara*: Faber-Langendoen 2249, Mandena STF; Faliniaina 33, Sainte-Luce; Humbert 20792, 20794, Vinanibe; Service Forestier 22297, Vinanibe; Service Forestier 34532, Sainte-Luce; Service Forestier 35298, Mandena STF; Service Forestier s.n., Bemangidy. — MAYOTTE: Labat 3340, Choungui; Pascal 213, 299, 564, Choungui; Pignal 1875, Choungui.

8. *Buxus monticola* G.E. Schatz & Lowry, sp. nov.

Buxus madagascari-ca subsp. *sambiranensis* H. Perrier, Fl. Madagascar 113: 4 (1952), nomen inval., non rite publ. sine Latin; *syn. nov.*

Haec species a Buxo madagascari-ca Baill. *trichomati-bus erectis brevibus caulem juvenilem petioli margines et laminae foliaris costam supra prope basem obtegentibus distinguitur.*

TYPUS. — *Malcomber* & *Rakotomalala* 2610, Madagascar, Prov. Antsiranana, Manongarivo RS, Bekolosy, 14°02'S, 48°18'E, 1000-1200 m, 4 Dec. 1993, fl., y.fr. (holo-, MO!; iso-, G!, K!, P!, TAN!).

Shrub or tree to 10 m tall. Stems with minute, erect trichomes, sometimes glabrescent. Leaves subcoriaceous to coriaceous, often corrugated, i.e., longitudinally convex on either side of the midrib, 1.2-3.3(-8) × 0.7-2.1(-4.3) cm, narrowly to broadly elliptic or rhombic, glossy, apex acute to rarely rounded, base acute to cuneate and decurrent along stem, margins strongly revolute, often with minute, erect trichomes toward the base, midrib slightly raised above and below, drying tan to yellowish and contrasting with green blade, with minute, erect trichomes above toward the base, sometimes glabrescent, venation weakly brochidodromous, 7-11 secondary veins per side, slightly impressed above or obscure, the tertiary venation densely reticulate and slightly raised above or obscure; petioles to 1 mm or leaves sessile, with minute, erect trichomes along margins, sometimes glabrescent. Inflorescences axillary; male flowers 1-3 per axil, subtended by 8 strongly keeled minute bracts, sepals 1-1.2 × 0.5-0.8 mm, broadly ovate, apex rounded, margins ciliate, anthers 2-3 × 0.5 mm; female flowers solitary on terminal portion of stems, subtended by 8 strongly keeled minute bracts, sepals 2.5-4 × 1.2-2.8 mm, lanceolate, apex acute, keeled, margins ciliate, ovary 2 × 1.5 mm, styles 5 mm, strongly recurved. Fruits 4-7 × 4.5-7 mm, globose, styler remnants 1.5-3 mm long, stout; seeds 5 × 2 mm, black, shiny. — Fig. 8.

Buxus monticola is a shrub to small tree that occurs in subhumid to montane evergreen forest from Manongarivo RS east to Tsaratanana RNI and Marojejy PN, and then at scattered localities from Tsinjoarivo as far south as Lalanandro north of Ihosy, from 800 to over 2000 m (Fig. 3). It can be distinguished from *B. madagascari-ca* by the short, erect trichomes covering the young stems, margins of the petiole, midrib above especially toward the base, and sometimes the margins of the blade toward the base.

VERNACULAR NAMES. — Hazombato, Pily pily vohitry, Somisika.

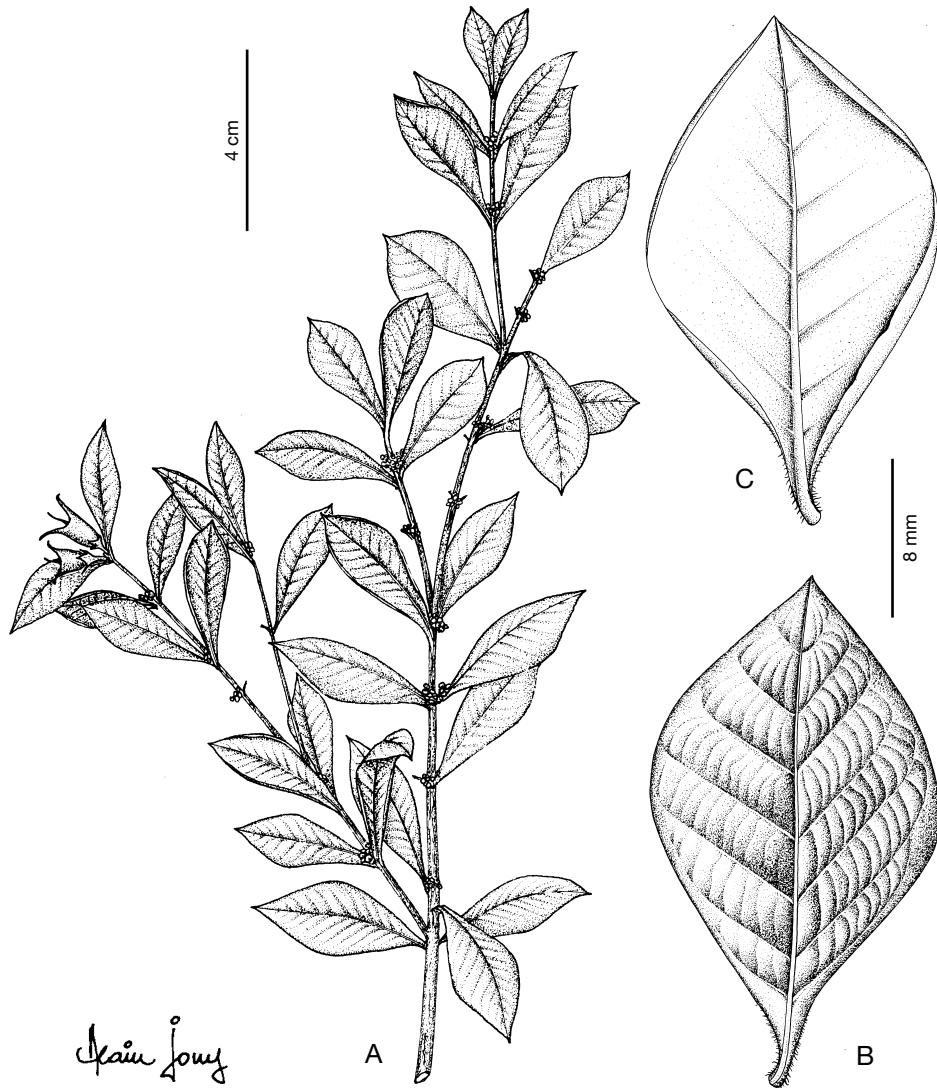


Fig. 8. — *Buxus monticola*: A, flowering and fruiting branch; B, leaf, adaxial surface; C, leaf, abaxial surface. (Malcomber & Rakotomalala 2610).

CONSERVATION STATUS. — With an Area of Occupancy of 700 km² within an Extent of Occurrence of c. 66,000 km², and a highly fragmented population known from less than 10 localities, *Buxus monticola* is assigned a preliminary status of Vulnerable (VU B2ab).

PARATYPES. — MADAGASCAR, *Prov. Antananarivo*: *Service Forestier 1028*, Ambatotsipihina-Tsinjoarivo,

[19°31'S, 47°21'E], 19 Nov. 1949, fr. (P, TAN, TEF). *Prov. Antsiranana*: *Gautier & Derleth 2592*, Manongarivo RS, Bekolosy, 14°02'S, 48°18'E, 1200 m, 28 Feb. 1996, fr. (G, MO, P, TAN); *Gautier & Be 2917*, same locality, 1240 m, 28 Feb. 1996, fr. (G, MO, P, TAN, TEF); *Humbert & Saboureaux 31909*, partie occidentale du massif de Marojejy (Nord-Est), de la vallée de l'Ambatoharanana, au bassin supérieur de l'Antsahaberoka, [14°28'S, 49°34'E], 1700 m, 15-25 Nov. 1959, fl. (MO, P); *Lewis, Rasoavimbahoaka & Rastefanonirina 1194*,

Marojejy PN, 14°26'56"S, 49°43'58"E, 1900-2130 m, 30 Sep. 1994, fr. (MO, P, TAN); *Malcomber, Hutcheon, Razafimanantsoa & Zjbra 1464*, Manongarivo RS, Antsatrotro, SE face, 14°05'S, 48°23'E, 1700-1760 m, 12 Apr. 1992, fr. (K, MO, TAN); *Perrier de la Bâthie 4609*, massif de Manongarivo [RS], [14°02'S, 48°21'30"E], 1600 m, May 1909, fr. (P); *Perrier de la Bâthie 5949*, same locality, Apr. 1909, fr. (P); *Rakotomalaza 44*, Manongarivo RS, Bekolosy, 14°04'S, 48°17'E, 1000-1480 m, Apr. 1993, fr. (G, K, MO, P, TAN); *Service Forestier (Capuron) 27042bis*, Centre: massif du Tsaratanana [RNI]: haut bassin de Beandrazina (Andranomena), affluent rive gauche de la Mahavavy, [13°49'S, 48°44'E], 2000-2300 m, 11 Nov. 1966, st. (P, TEF); *van der Werff & McPherson 13480*, Manongarivo RS, above village of Ambodisakaona, 14°05'S, 48°20'E, 1100 m, 16 Oct. 1994, fl. (K, G, MO, P, TAN). *Prov. Fianarantsoa*: Ouest: *Service Forestier (Capuron) 23522*, versant oriental du massif de Lalanandro, au nord d'Ihoso, [22°19'S, 46°07'30"E], 800-1000 m, 9 Oct. 1964, fl. (MO, P, TEF); *Service Forestier (Capuron) 23857*, Centre: massif du Vohibe-Antoetra au S-SE d'Ambositra, [20°48'S, 47°20'E], 1600-1869 m, 1 Dec. 1964, fl. (K, MO, P, TEF).

9. *Buxus moratii* G.E. Schatz & Lowry, **sp. nov.**

Buxus madagascariensis subsp. *trophophila* H. Perrier, Fl. Madagascar 113: 4 (1952), nomen inval., non rite publ. sine Latin; *syn. nov.*

Haec species lamina foliari ad vel infra medium latiore ad congeneros madagascariensis nonnullos accedit, sed ab eis foliis lanceolatis usque anguste lanceolatis apice longe acuminatis usque cuspidatis marginibus planis distinguitur.

TYPUS. — *Noyes, Harder, Rakotobe, Razafindrabeaza & Abraham 1005*, Madagascar, Prov. Toliara, Kirindy forest concession of CEPF, 55 km NE of Morondava, 5-5.5 km E of route 8, 20°04'S, 44°40'E, 35 m, 14-16 Mar. 1992, fr. (holo-, MO!; iso-, K!, P!, TAN!).

Shrub 2-6 m tall, completely glabrous. Stems 0.6-1 mm in diam, internodes 0.6-1.7 cm. Leaves chartaceous to subcoriaceous, matte to somewhat glossy, 2.6-8 × 0.6-2.1 cm, narrowly lanceolate to ovate, apex acuminate to cuspidate, the acumen 1-3.5 cm long, base cuneate to attenuate and decurrent along stem, secondary venation obscure or faintly visible above and below, brochidodromous, with 8-10 lateral veins per side; leaves sub-

sessile. Inflorescences axillary, either with 3-4 male flowers, or 2 lateral male flowers and a central terminal female flower, or with a solitary female flower; male flowers subtended by 8-16 minute, decussate bracts, sepals 0.5 × 1.1 mm, anthers 1.8 × 0.4 mm, fused at their base; female flowers subtended by 8-16 minute, decussate bracts, sepals 1 × 1 mm, accrescent, scarious in fruit, expanding to 1.6 × 1.8 mm, styles 3 mm long, strongly recurved. Fruits 5-7 × 4-5 mm, ellipsoid, stylar remnants 2-3 mm long; seeds 3.2-4.8 × 1.2-2 mm, black, shiny. — Fig. 9.

Buxus moratii is a small to large shrub that occurs in western dry deciduous forest from north-east of Toliara to the plateau d'Ankara, as well as a disjunct sub-population on Mt. Combani on Mayotte in the Comoro archipelago (Fig. 3), possibly in moister forest. It can be easily recognized by its lanceolate to narrowly lanceolate leaves with a long acuminate to cuspidate apex.

ETYMOLOGY. — The species epithet honors Prof. Philippe MORAT of the Muséum National d'Histoire Naturelle in Paris, who conducted his thesis research in the area where *Buxus moratii* occurs, and who has encouraged our study of the Malagasy flora.

VERNACULAR NAME. — Tsivoaninombozo.

CONSERVATION STATUS. — With an Area of Occupancy of 900 km² within an Extent of Occurrence of c. 36,000 km² and only 5 sub-populations (including the disjunct sub-population on Mayotte), *Buxus moratii* is assigned a preliminary status of Vulnerable (VU B2ab).

PARATYPES. — MADAGASCAR, *Prov. Mahajanga*: *Perrier de la Bâthie 2261*, Kamakama sur le plateau d'Ankara, [16°55'S, 46°29'E], Oct. 1901, fr. (P). *Prov. Toliara*: *Abraham 2*, forêt de Marosalava, 50 km N of Morondava, [20°02'S, 44°33'E], 0 m, 30 Mar. 1974, fl. (MO, P); *Bernardi 11400*, per viam Tulear-Ihoso ad km 44, [23°15'S, 43°59'E], 250-300 m, 12 Nov. 1967, fl. (G, K, P); *Chauvet 258*, PK 47 route Tulear-Tananarive, [23°14'S, 44°01'E], 10 Feb. 1962, fr. (K, MO, P, TEF); *Chauvet s.n.*, PK 40 route Tulear-Tananarive, [23°10'S, 44°03'E], fr. (TEF); *Gillespie 4112*, Swiss Forestry Camp, c. 45 km NE of Morondava, 20°03'S, 44°37'E, 30 m, 7-8 Nov. 1990, fl. (K, MO); *Jacquemin 781bis*, forêt à l'extrémité Sud-Ouest du lac Masama S/P. d'Antsalova, [18°51'S, 44°27'E], 0 m, 15 Nov. 1973, fl. (P); *Morat 3719*,

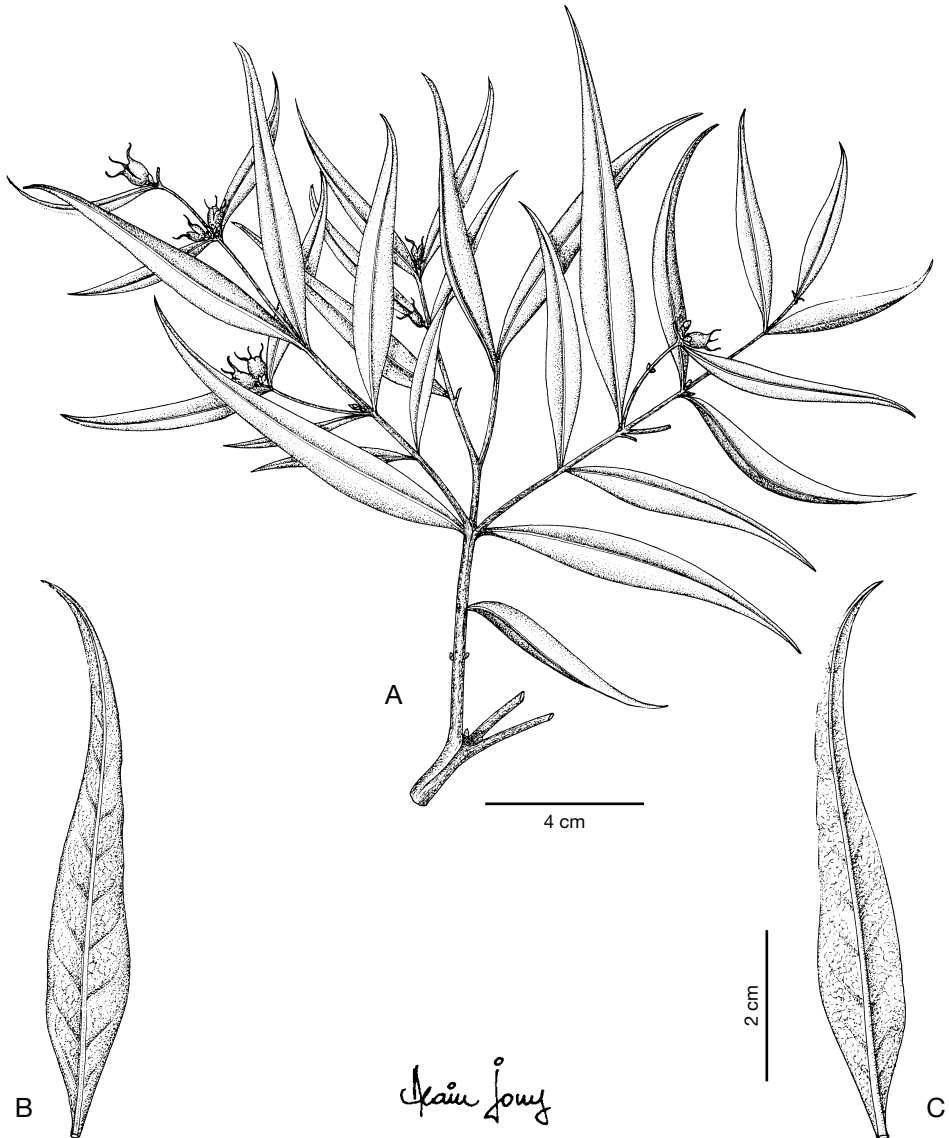


Fig. 9. — *Buxus moratii*: **A**, fruiting branch; **B**, leaf, adaxial surface; **C**, leaf, abaxial surface. (Noyes et al. 1005).

Nord de Morondava, [20°17'S, 44°17'E], Nov. 1970, fl. (MO, P, TAN); *Petter 20*, forêt de Marosalava, 50 km N of Morondava, [20°02'S, 44°33'E], 0 m, 15 Nov. 1973, fl. (P); *Rabanyamalala 26*, Morondava, [20°17'S, 44°17'E], 1990, fr. (P); *Rakotozafy 1063*, forêt de Marofandilia, Morondava, [20°08'S, 44°33'E], 29 July 1970, st. (TAN); *Rauh 10447*, Sakaraha [STF], [22°56'S, 44°33'E], 31 July 1963, fl. (TAN); *Service Forestier (Capuron) 20770*, Ouest

(confins du Sud-Ouest): forêt tropopylle basse dégradée entre Befoly et Analamitsivilana (à l'est du PK 38 de la route Tulear-Sakaraha), [23°18'S, 43°56'E], Jan. 1962, fl. (MO, P, TEF); *Service Forestier (Capuron) 28923*, Ouest: forêt d'Andranomena-Marofandilia (Morondava), [20°09'S, 44°30'E], 28-29 Nov. 1969, fl. (K, MO, P, TEF). — MAYOTTE: *Humboldt 1403*, forêt de Combani, [12°48'S, 45°09'E], 14 Nov. 1884, st. (MO, P).

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