

Taxonomic revision and distribution of herbaceous *Paramollugo* (Molluginaceae) in the Eastern Hemisphere

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Abstract

The genus *Paramollugo* with the type species *Paramollugo nudicaulis* ($\equiv$ *Mollugo nudicaulis*) has recently been described after molecular investigations. Here we report two new endemic Malagasy species: *Paramollugo simulans* and *P. elliotii*, and transfer a forgotten New Caledonian endemic *Mollugo digyna* to *Paramollugo* (*P. digyna*). Consequently, the number of *Paramollugo* species in the Eastern Hemisphere is increased from three to six. Almost all genus representatives (except *P. nudicaulis*, which has a wide distribution in Southern Asia, Arabia and tropical Africa) are endemic to Madagascar, Somalia, or New Caledonia. Since the type of seed coat ornamentation is crucial for species delimitation, a diagnostic key with new taxonomically significant carpological characters and other new traits is provided for all the herbaceous *Paramollugo*. The distribution patterns of *P. nudicaulis* s.str., *P. simulans* and *P. elliotii* are presented.

Keywords

Madagascar, *Mollugo*, New Caledonia, new species, seed characters, taxonomy

Introduction

The new genus *Paramollugo* Thulin has recently been split from *Mollugo* s.l. after molecular investigations (Thulin et al. 2016). It comprises five herbaceous species and one small shrub, the Malagasy *P. decandra* (ex-*Mollugo decandra*). Herbaceous *Paramollugo* species clearly differ from all other Molluginaceae by having rosulate leaves only. The inflorescences in herbaceous *Paramollugo* are bracteose, dichasial or trichasial ('pseudo-dichotomous'), with long inflorescence stems (Batenburg et al. (1984) sub *Mollugo*)

and numerous sterile branches up to 2.5 cm long, which are rarely seen in Molluginaceae. The seeds of some species have only recently been investigated (Hassan et al. 2005 sub *Mollugo*; Sukhorukov and Kushunina in press), and their morphology and ornamentation support the data obtained from a molecular phylogeny study (Christin et al. 2011), which suggests that *Paramollugo angustifolia* and *P. navassensis* are close to *P. nudicaulis*. The following herbaceous species were accepted after establishing the new generic name (Thulin et al. 2016): *Paramollugo nudicaulis* (type species) with wide distribution in the Eastern Hemisphere, *P. angustifolia* known only from the type locality in south-central Somalia (Gilbert and Thulin (1993) sub *Mollugo angustifolia*), *P. cuneifolia* (Grisebach (1866) sub *Mollugo nudicaulis* var. *cuneifolia*), *P. deltoidea* from Cuba (Léon (1950) sub *Mollugo deltoidea*), and *P. navassensis* from several Caribbean islands (Ekman (1929) sub *Mollugo nudicaulis* var. *navassensis*). Morphologically, these species differ in life form (annual or perennial), leaf shape and sometimes leaf width (Gilbert and Thulin 1993; Thulin et al. 2016).

We have previously shown that seed morphology and ultrasculpture are very useful for the diagnostics and taxonomy of major groups within the former *Mollugo* s.l., and that the ‘*Mollugo nudicaulis*’ group (= *Paramollugo*) needs further taxonomic studies (Sukhorukov et al. 2016; Sukhorukov and Kushunina in press). Here we provide a closer look at the taxonomy of the herbaceous *Paramollugo* taxa and discuss new morphological characters essential for delimiting the taxa within this complicated group.

Materials and methods

The revision of herbarium material was undertaken in the collections B, BM, BR, E, HUJ, K, LE, M, MHA, MSB, MW, P, PRA, W, and WU (acronyms follow Thiers 2016+). In the herbaria visited in 2015–early 2016, prior to the publication of the new taxonomic revision of Molluginaceae (Thulin et al. 2016), the specimens belonging to the new *Paramollugo* species described here were labelled by us as *Mollugo* (including the holotype specimens). The distribution maps of *Paramollugo nudicaulis*, *P. angustifolia*, *P. elliotii* and *P. simulans* are based upon the specimens examined in the herbaria listed above. These specimens are cited in the Results and Discussion section for the new taxa and combination or in the Appendix for *Paramollugo nudicaulis* and *P. angustifolia*. Countries are listed in alphabetical order.

The seed surface of *Paramollugo* was examined using scanning electron microscopy (SEM; JSM–6380, JEOL Ltd., Japan) at 15 kV after sputtercoating with gold-palladium. Fallen fruits (1–2) from the following vouchers were used for SEM:

Paramollugo digyna (Montrouz.) Sukhor.: NEW CALEDONIA. Canala, [without date] anonym 236 (BM); 1861–1867, *Viellard* 120 (K); 1870, *Pancher* 236 (K, P04583449); Lower slopes of Mt. Kafeate, 30 March 1956, *H.S. McKee* 4228 (E, K); *P. elliotii* Sukhor.: MADAGASCAR. Ambongo, 14 February 1841, *M. Pervillé* 643 (P04582808); Mailake prov., February 1890, *M. Douillot s.n.* (P04582888); Baie

- de Baly, January 1905, *H. Perrier de la Bathie* 9211 (P04582813); Majunga, 27 April 1912, *Afzelius s.n.* (K); Environs de Majunga, December 1924, *H. Humbert & H. Perrier de la Bathie* 4020 (P04582873);
- P. nudicaulis* (Lam.) Thulin: BHUTAN. Tashigang distr., Dangme Chu valley, 3000 ft, 17 August 1915, *Cooper & Bulley* 4498 (BM); CENTRAL AFRICAN REPUBLIC. Bossangoa, 12 November 1981, *Fay s.n.* (K); MADAGASCAR. [without precise location and date] *R. Capuron s.n.* (P04582819); Nasi-Be, May 1879, *Hildebrandt* 2974 (LE); Tulear, 6 January 1988, *Phillipson* 2800 (K); SENEGAL. Basse-Casamance, October 1988, *van den Berghen* 8188 (BR0000017458177); UGANDA. Singo co., 13 April 1970, *Katende* 103 (K); TOGO. Lomé to Cacaveli, 14 April 1978, *Hakki et al. s.n.* (B); YEMEN. Socotra, 4 km SE of Hadiboh, 19 February 1989, *Miller et al.* 8225 (E);
- P. simulans* Sukhor.: MADAGASCAR. Vaingaindrano, [without date] *Scott Elliot* 2257 (BM, K, E); Majunga, October 1924, *H. Humbert* 4079 (P04582884); Fenerive [Fenoarivo], 7 September 1959, *Rauh* 169 (M); Majunga province, 25 February 1985, *Dorr et al.* 3810 (K); Beloka, 1 December 1989, *Dupuy* 2448 (K); near Andranokoditra, 7 February 1990, *Bogner* 2084 (M); Toliara, Belalanda, 17 March 2006, *R. Ranaivojaoana et al.* 1442 (K).

Results

Six *Paramollugo* species in the Eastern Hemisphere (*P. angustifolia*, *P. decandra*, *P. digyna*, *P. elliotii*, *P. nudicaulis*, *P. simulans*) are accepted in the present paper, instead of the three previously recognized species (*P. angustifolia*, *P. decandra*, and *P. nudicaulis*). The core species, *P. nudicaulis* s.str., is found to be widely distributed in the tropics of the Eastern Hemisphere as a weed species (see Fig. 1 and Appendix for vouchers), and this conclusion is supported by morphological and carpological (including SEM) comparison of the observed specimens. *Paramollugo* is best represented in Madagascar, where four species are found: herbaceous *P. simulans*, *P. elliotii*, *P. nudicaulis*, and shrubby *P. decandra*. Except for *P. nudicaulis*, all species are endemics of this island. Another enigmatic taxon described as *Mollugo caespitosa* (Scott Elliot 1891) and included in the list of Madagascan endemics (Clifton 2012) is now synonymized with *M. decandra* (Sukhorukov et al. 2016).

The genus *Paramollugo* in the Eastern Hemisphere is one of the most morphologically difficult groups in Molluginaceae. We found that the following reproductive characters are useful for delimiting the *Paramollugo* species: size of the perianth segments, length of the anthers, number of stylodia and locules in the capsule, and seed shape and ornamentation. Seed surface is either papillate (*P. digyna*, *P. decandra*, *P. nudicaulis*; Fig. 2) or colliculate (*P. angustifolia*, *P. elliotii*, *P. simulans*; Fig. 3), while the secondary ornamentation of the testa cells is cross-striate in *P. nudicaulis* and warty in *P. digyna*, or absent in *P. angustifolia*, *P. decandra*, *P. elliotii*, and *P. simulans*. All six species are united in having small pits in the boundaries between seed coat cells (but the pits are hardly discernible in *P. elliotii*).

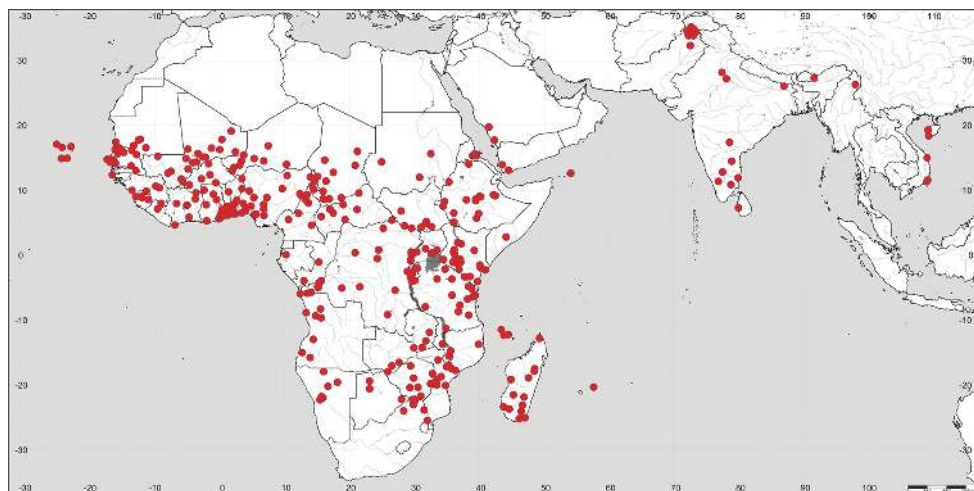


Figure 1. Distribution of *Paramollugo nudicaulis* in the Eastern Hemisphere.

Key to the delimitation of herbaceous *Paramollugo* species in the Eastern Hemisphere

Paramollugo decandra is not included in the text; it is a small shrub (this character differentiates this species from all other *Paramollugo* in this region, which are herbs)

- 1 Seeds with well-visible papillate ornamentation and warty or striate outgrowths of the testa cells **2**
- Seeds without distinct papillae **3**
- 2 Annual; leaves obovate or oblong; capsules three-valved; outer wall of the testa cells striate, without warty outgrowths
..... ***P. nudicaulis*** (tropical Africa and Asia)
- Annual or perennial herb; leaves reniform or almost triangular; capsules usually two-valved; outer wall of the testa cells with several or numerous warty outgrowths..... ***P. digyna*** (New Caledonia)
- 3(1) Perennial herb with numerous (25–50) linear or lanceolate sessile leaves to 5 mm wide, not divided into petiole and lamina; anthers 0.55–0.70 mm; outer perianth segments 2.6–3.0 mm..... ***P. elliotii*** (Madagascar)
- Annuals with 5–20 leaves of different shape; anthers 0.25–0.35 mm; perianth segments at fruiting stage not exceeding 2.5 mm in length **4**
- 4 Leaves linear, to 2 mm wide; seeds 0.35–0.45 mm in diameter.....
..... ***P. angustifolia*** (Somalia)
- Leaves usually oblong to obovate, to 12 mm; seeds 0.55–0.7 mm in diameter ***P. simulans*** (Madagascar)

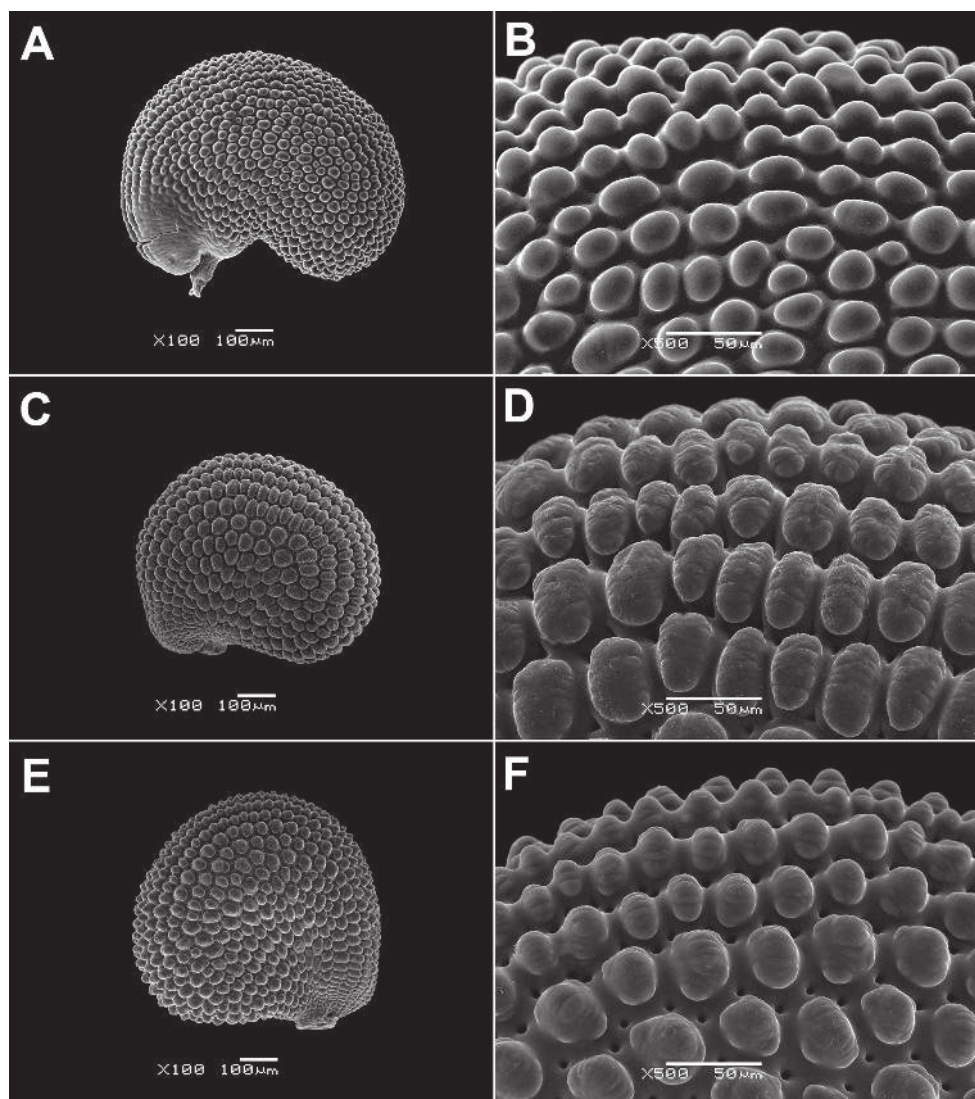


Figure 2. SEM micrographs of the seed surface. **A, B** *P. decandra* **C, D** *P. digyna* **E, F** *P. nudicaulis*.

***Paramollugo simulans* Sukhor., sp. nov.**

urn:lsid:ipni.org:names:77158272-1

Holotype. MADAGASCAR, [Atsimo-Andrefana region], Toliara [district], Belalanda, Ranobe, 4 km a l'Est du village Andrevo, 22°58'20"S, 43°36'56"E, 135 m, 17 March 2006, *R. Ranaivojaoana et al.* 1442 (holotype K000607662; isotype BR0000000514054, P05196698). (Fig. 4).

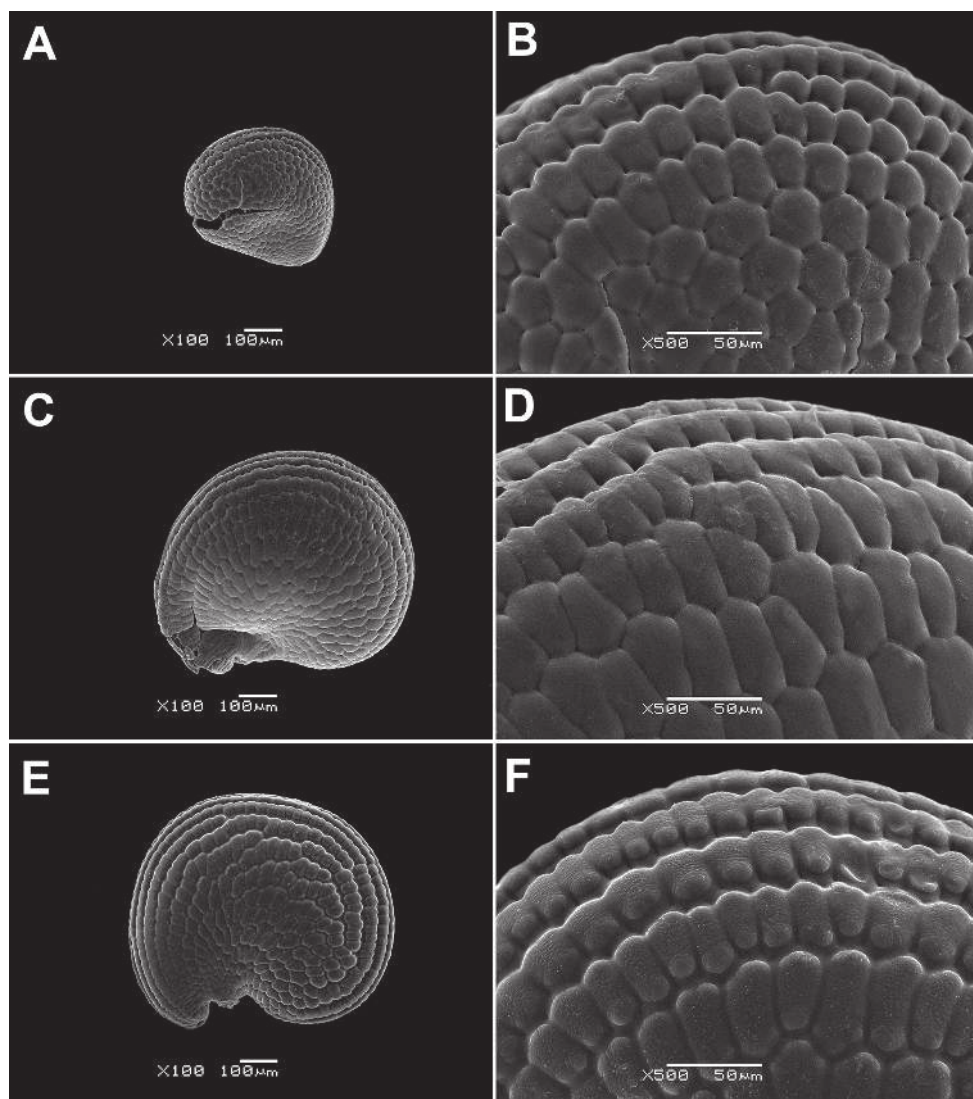
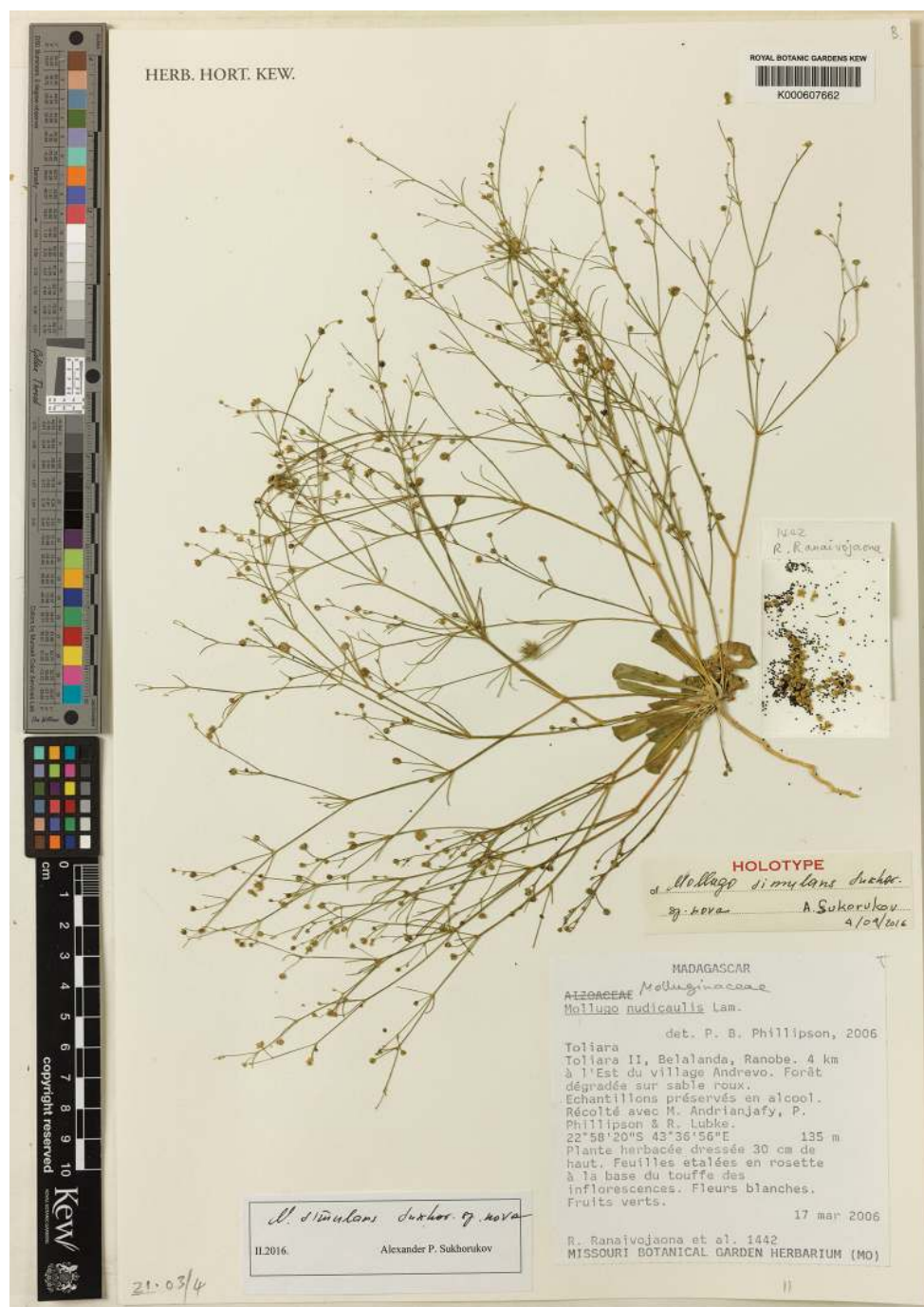


Figure 3. SEM micrographs of the seed surface. **A, B** *P. angustifolia* **C, D** *P. elliotii* **E, F** *P. simulans*.

Diagnosis. *Paramollugo simulans* is morphologically similar to *P. nudicaulis* but differs by having colliculate seed surface (testa cells slightly convex, not papillae-like) with no striate secondary cell ornamentation. Some forms of *P. simulans* with linear leaves look like *P. angustifolia*, but they reliably differ by the seed size (0.55–0.7 mm and 0.35–0.45 mm, respectively).

Description. Annual to 25(30) cm; leaves (5–9)10–25, rosulate, rather thin, obovate, narrowly oblong, sometimes lanceolate, 20–50 × 2–12 mm, continuously tapered in petiole (up to 20 mm) or rarely not clearly divided into petiole and blade if lanceolate or linear, glabrous or shortly papillate; stems many (rarely 1 in underdeveloped

Figure 4. Holotype of *Paramollugo simulans* sp. nov. (K1).

exemplars), branched in the middle part with many lateral branches forming loose inflorescence with semi-spherical habit, always with short (up to 20 mm) sterile branches (not carrying flowers); peduncles to 15 mm, basally with white or brownish bract to 1.5 mm; flowers 3–4 mm in diameter when open; perianth segments 1.3–1.7 mm long in flowering, 2–2.4 mm long in fruiting, ovoid, green from abaxial side, white or pinkish inside; stamens 5 to 10, anthers elliptic, 0.30–0.35 mm; capsule 3-valved, ovoid, 1.5–2.3 mm, contains (8)10–18 seeds; seeds are reniform, dark red or almost black, $0.55\text{--}0.7 \times 0.6 \times 0.3$ mm, with colliculate ultrasculpture.

Ecology. Sandy, rocky, ruderal sites or dry forests at elevations 0–1700 m.

Flowering and fruiting. November–June.

Additional specimens examined. MADAGASCAR: **Alaotra-Mangoro region:** Moramanga, Andasibe, Berano, Ambatovy forest, Analamay, $18^{\circ}49'05''\text{S}$, $48^{\circ}19'25''\text{E}$, 1145 m, 24 February 2005, *P. Antilahimena et al.* 3464 (P05196697); **Androy region:** Beloha, $25^{\circ}05'\text{S}$, $45^{\circ}10'\text{E}$, alt. 125 m, deciduous thicket with Indigofera & Crotalaria, locally common, 1 December 1989, *Dupuy* 2448 (K); **Anosy region:** Fort Dauphin [Tolanaro], St. Luce, 1 May 1989, *N. Dumetz* 720 (P04582891); **Atsinanana region:** Vaingaindrano, [without date] *Scott Elliot* 2257 (BM, K, E); Vatomandry distr., forêt de copaliers, February 1904, *J. Guillot* 69 (P04582879); bei Andranokoditra, entlang der Lagune wachsend, 7 February 1990, *Bogner* 2084 (M); Toamasina, Fokontany Ampitambe, Ambatovy, $18^{\circ}50'04''\text{S}$, $48^{\circ}17'46''\text{E}$, 1107 m, 15 February 2005, *H. Razanatsoa et al.* 121 (P05196696); **Boeny region:** Environs de Majunga, 1908, *H. Perrier de la Bathie* 5233 (P04582816); Majunga [Mahajanga], 27 April 1912, *K. Afzelius s.n.* (K); Environs de Majunga, October 1924, *H. Humbert* 4079 (P04582884); Majunga province, poste forestier d'Ampijoroa (Jardin Botanique), forêt sèche sur sable, $16^{\circ}14'\text{S}$, $46^{\circ}28'\text{E}$, 25 February 1985, *L.J. Dorr, L.C. Bennett & M.R. Cheek* 3810 (BR0000017461078, K); Mahajanga, Analalava, appr. 25 km E of Analalava towards Antsohihy, $14^{\circ}46'03''\text{S}$, $47^{\circ}47'53''\text{E}$, 178 m, low dry forest, 21 June 2008, *M. Andriamahay & S. Rakotoarisoa* 0466479 (K); **Haute Matsiatra region:** Fenerive [Fenoarivo], 7 September 1959, *Rauh* 169 (M); Fianarantsoa, Fivondroana, Nosy Varika, Firaiana, Ambahy, $20^{\circ}47'49''\text{S}$, $48^{\circ}28'58''\text{E}$, 10 m, 23 April 2004, *R. Razakamalala, R. Ranaivojaona & Z. Rogers* 1208 (P05196706); **Ihorombe region:** Menarahaka, Ihosy, 700–800 m, vestiges de forêt tropophile sur terrains siliceux, 1955, *H. Humbert* 28574 (P04582868); plateau et vallées de l'Isalo à l'Ouest de Ranohira, gres et sables siliceux, 1955, *H. Humbert* 28729 (P04582852; P04582855); **Melaky region:** Beanka, East Ambinda, $18^{\circ}02'24''\text{S}$, $44^{\circ}28'31''\text{E}$, 222 m, 2 April 2013, *L. Ranaivoarisoa* 054 (BR0000015215840); **Sofia region:** Marokitraro, 27 December 1922, *Decary* 1392 (P04582900); **Vakinankaratra region:** Antananarivo, Antsirabe, 1669 m, exposed rock, 26 February 2008, *M. Andriamahay & S. Rakotoarisoa* 0452506 (K); **Vatovavy-Fitovinany region:** Mananjary prov., 1909, *F. Geay* 7636 & 7790 (P04582870; P04582871; P04582872); Ambila, 7 May 1928, *M. Decary* 6422 (K).

General distribution. Endemic to Madagascar (Fig. 5).

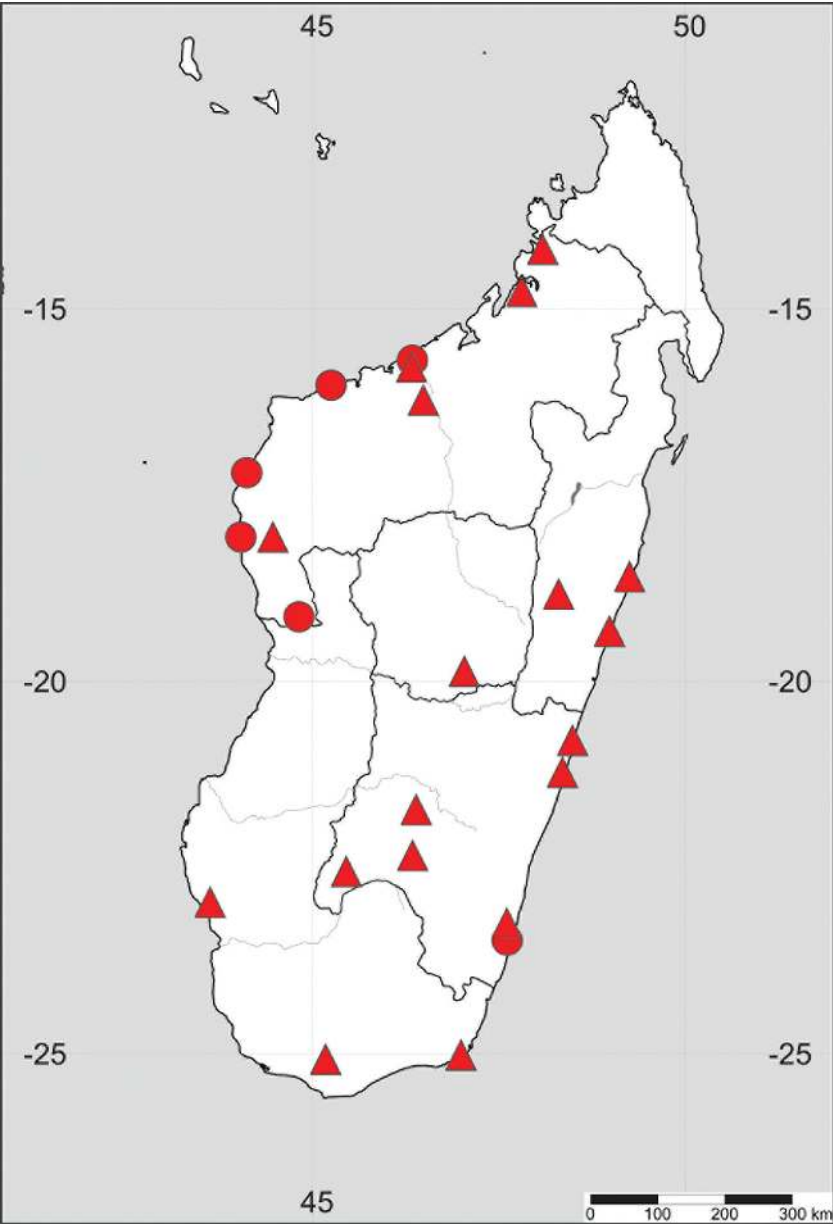


Figure 5. Distribution of *Paramollugo simulans* (triangles) and *P. elliotii* (dots).

Conservation status. Although a rather limited number of specimens is available, it is clear that *P. simulans* can occupy disturbed habitats and is therefore unlikely to be at risk of extinction. Following the IUCN (2016) guidelines, this species should be categorized as not threatened.

Etymology. The specific epithet “simulans” means “imitating” and refers to the morphological similarities of the new species and *Mollugo nudicaulis*.

***Paramollugo elliotii* Sukhor., sp. nov.**

urn:lsid:ipni.org:names:77158273-1

Diagnosis. *P. elliotii* is morphologically similar to both *P. nudicaulis* and *P. simulans*, but differs by perennial life form, narrow (linear to oblanceolate), (sub)sessile leaves, larger anthers (0.55–0.70 mm), and larger outer perianth segments (2.6–3 mm) at the fruiting stage (*P. nudicaulis* and *P. simulans* are annuals, with broader, usually petiolate leaves, anthers of 0.25–0.30 mm and smaller perianth to 2.4 mm long).

Holotype. MADAGASCAR, province du Mailake [Melaky region], sable des dunes [sand dunes], Fevrier [February] 1890, *M. Douillot s.n.* (P04582888!). (Fig. 6).

Description. Perennial herb to 35–40 cm; leaves 25–50, rosulate, thick, linear to oblanceolate, (10)20–60 × 0.5–5.0 mm, sessile or not clearly divided into petiole and lamina, glabrous; stems several, stout, branched in the middle part and forming loose semi-spherical inflorescence with numerous lateral branches, sterile (up to 30 mm) branches always present; peduncles to 15 mm long, basally with white or brownish bract 0.7–1.2 mm long; opened flowers 3.5–4.5 mm in diameter; perianth segments ovoid, green on the abaxial side, white or pink inside, 1.5–2.0 mm in flowering, unequally enlarging at fruiting stage (three outer segments 2.6–3.0 mm long, two inner 2.3–2.6 mm long); stamens 5, anthers elliptic, 0.55–0.7 mm long; capsule 3-valved, ovoid, ca. 2 mm long, with (9–14)15–21 seeds; seeds reniform, black, 0.55–0.7 × 0.5 × 0.3 mm, with colliculate surface.

Ecology. All examined specimens were collected on the sand dunes near the sea at lower elevations 0–300 m. We assume that *P. elliotii* is a psammophilous species.

Flowering and fruiting. All examined specimens (collected in January, February, July, September or December) bear both flowers and fruits. However, the exact phenology has to be investigated more precisely, since it can depend on the geographical latitude and other conditions.

Additional specimens examined. MADAGASCAR: **Atsimo-Atsinanana region:** Ambongo, 14 February 1841, *M. Pervillé 643* (K, P04582808; P04582809; P04582810); **Melaky region:** province de Mailake, Namela, dunes, February 1892, *M. Douillot s.n.* (P04582869, P04582886); Baie de Baly, January 1905, *H. Perrier de la Bathie 9211* (P04582813; P04582814); along Manambolo river, 19°09'S, 44°49'E, 50 m, 2 December 1996, *C.C.H. Jongkind 3342* (BR0000000555871); **Boeny region:** Majunga, 27 April 1912, *Afzelius s.n.* (K); Majunga, dunes, 24 December 1920, *H. Poisson 44* (P04582831); Environs de Majunga, dunes, December 1924, *H. Humbert & H. Perrier de la Bathie 4020* (K, P04582873) & 2020 (P04582874; P04582877);

General distribution. Endemic to Madagascar (Fig. 5).

Conservation status. All except one specimen are nearly a hundred years old or even older, and no information is available on the current extent of the wild populations of this species. Therefore *P. elliotii* is given a Data Deficient (DD) status (IUCN 2016).

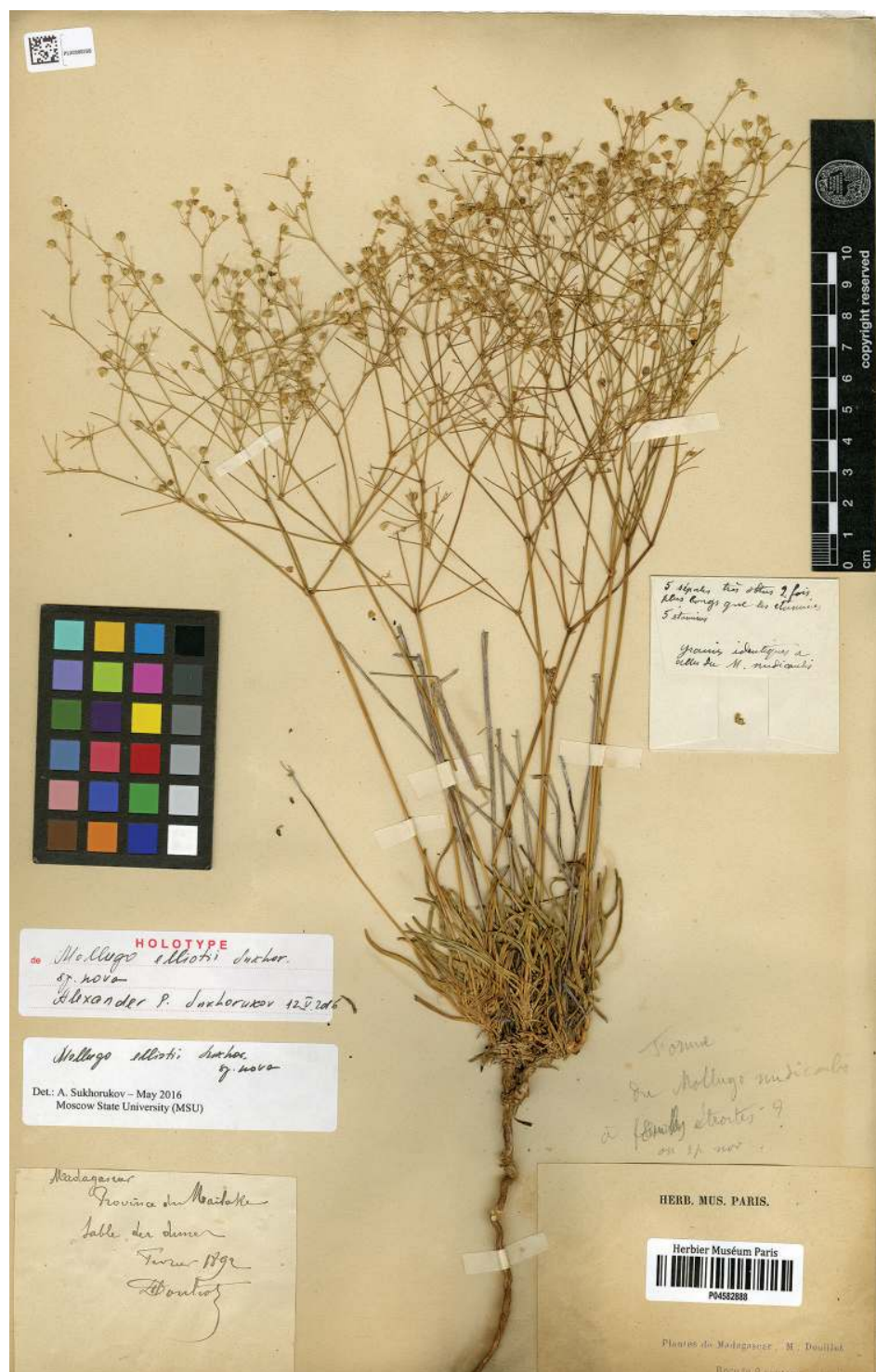


Figure 6. Holotype of *Paramollugo elliptii* sp. nov. (P04582888!).

Etymology. The specific epithet is given after after George Francis Scott Elliot (1862–1934), a British botanist who provided significant contributions to the flora of Madagascar.

***Paramollugo digyna* (Montrouz.) Sukhor., comb. nov.**

urn:lsid:ipni.org:names:77158274-1

Basionym: *Mollugo digyna* Montrouz., Ann. Acad. Roy. Sci. Lyon, Sect. Sci. 10: 179 (1860).

Neotype (Sukhorukov, selected here). NEW CALEDONIA. West face of Massif de Koniambo, 300 m, iron-serpentine scrub on track through “maquis”, 11 October 1963, P.S. Green 1287 (K001045648!).

Discussion. This taxon described by X. Montrouzier was completely forgotten and cited as *Mollugo nudicaulis* in the treatments of the New Caledonian flora (e.g., Guillaumin 1948, Rageau 1973). However, *P. digyna* is easily recognized by unique reniform or even triangular leaf blades (Fig. 7), and by a tendency to become a short-lived perennial (in contrast to annual *P. nudicaulis*). Unfortunately, many specimens were collected without the basal portion or in their first growing season, and it is still unclear which life form is predominant in *P. digyna*. Neither perennial habit nor unusual leaf shape were mentioned in the protologue (Montrouzier 1860), but the author indicated the presence of two-valved capsules. We also found that the specimens collected in New Caledonia have two- or rarely three-valved capsules with 8 or fewer seeds, in contrast to other herbaceous *Paramollugo*, which are characterized by capsules with three locules and up to 30 seeds. The outer walls of the testa cells are elongated, almost rectangular, with secondary warty outgrowths. A similar seed surface was observed in the Caribbean *P. navassensis* and is clearly distinct from *P. nudicaulis* (Sukhorukov and Kushunina in press, sub *Mollugo*).

No original material of *Paramollugo digyna* was traced. The herbarium of X. Montrouzier, who described *M. digyna*, is located in University of Montpellier herbarium (MPU), with some duplicates in the National Museum of Natural History, Paris (P). Only one specimen of *P. digyna* was found, without a precise location (MPU-310526). No specimens are cited in the protologue (Montrouzier 1860). The sheet found in MPU (no. 169) and dated 1866 might have been collected later, and hence cannot be considered as original material. However, the plant clearly originates from New Caledonia due to the writing on the sheet “*Stylos binos semper, capsulamque bivalvam vidi!*” (“stylodia always two, capsule two-valved”). Since the original material is not found (Art. 9.16 of ICN) here we select a neotype that bears a plant with perennial life form, reniform leaves and two-valved capsules as the most indicative characters of *P. digyna*.

Paramollugo digyna is known only from New Caledonia where it usually grows on rocky or stony substrates; locally common (Guillaumin 1964 sub *Mollugo nudicaulis*). *Paramollugo nudicaulis* s.str. is not present in New Caledonia.

Examined specimens (selected specimens). NEW CALEDONIA: Kanala [Canala], 1859–1860, Viellard (BR); [no precise location] 1861–1867, Viellard 120

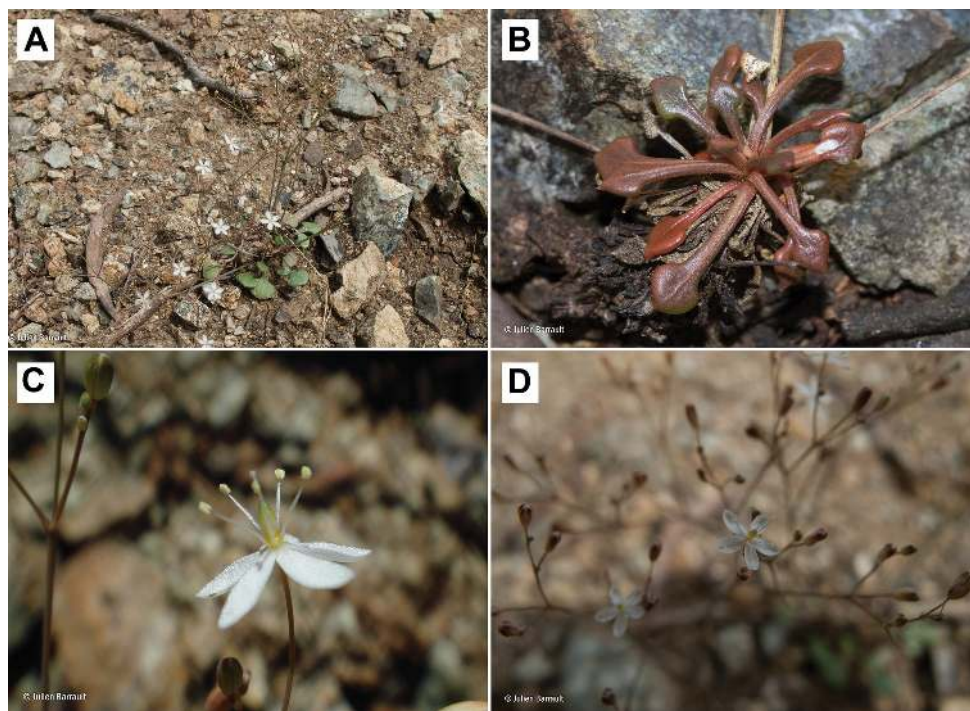


Figure 7. *Paramollugo digyna*. **A** general habit **B** leaf rosette **C** flower **D** inflorescence. Photographs by Julien Barrault.

(K); [no precise location] 1870, *Pancher* 236 (BM, K, P04583449); Canala, 2000 ft, 17 February 1914, *Compton* 1251 (BM); Lower slopes of Mt. Kafeate, 30 March 1956, stony ground, *H.S. McKee* 4228 (E, K).

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Appendix

Specimens of *Paramollugo nudicaulis* from the Eastern Hemisphere and *P. angustifolia* examined in the herbaria visited.

P. angustifolia:

SOMALIA, Bay region, c. 3 km SW of Dilinsoor, near Buur Dilinson, 2°24'N, 42°58'E, 20 May 1990, *Thulin, Hedrén & Abdi Dahir* 7606 (K!, B! – isotypes).

Paramollugo nudicaulis:

ASIA:

BHUTAN: Tashigang distr., Dangme Chu valley, 3000 ft, 17 August 1915, *Cooper & Bulley* 4498 (BM).

CEYLON: Bolawatta, 16 July 1932, *Simpson* 9864 (BM); *Thwaites* 2809, without date (P04601254).

CHINA: **Hainan**: Ngai distr., Naam Shan Leng, 17 July 1932, *S.K. Lau* 271 (P04601248, E); Ch'ang-kiang [Changjiang] distr., 23 May 1933, *Lau* 1788 (BM, P04601252); [without precise location], 27 July 1933, *Liang* 62270 (E).

INDIA: nr Madras [Chennai], 1856, Cleghorn s.n. (E); Madras [presidency], October 1885, *Gamble* 18217 (BM); **Andhra Pradesh state**: Madras [Chennai], Cud-dapah [Kadapa] distr., February 1886, *Gamble* 10831 (K); Hyderabad, 5 August 1978, *van der Maesen* 3868 (K); **Bihar state**: [no precise location and date] Clarke s.n. (LE); **Haryana state**: Palwal, June 1845, *Thomson* s.n. (K); **Karnataka state**: between Bangalore and Ramanagaram, 29 January 1952, *A. Gilli* s.n. (W); **Puducherry state**: Pondichery, 1835, *M. Perrottet* s.n. (P04601255); near Pondichery, December 1864, *L. Pierre* 3662 (P04601257, P04601261); **Tamil Nadu state**: Nilghiri [Mts.], *Thomson* s.n. (BM, K); Tiruchi[rappalli] distr., Srirangam island, 13 August 1977, *Matthew* 8345 (K); **Uttar Pradesh state**: Agra, 11 October 1952, *K.L. Mehra* s.n. (WU).

MYANMAR: Upper Burma [without precise location] 12 September 1990, *Huk* s.n. (E).

PAKISTAN: **Khyber Pakhtunkhwa province**: Akora, 1862, *Griffith* 2471 (K); Mansehra, 29 September 1888, *Duthie* 7480 (K); Swat state [district], nr Madian [Madyan], 14 August 1952, *Rodin* 5508 (K); Swat, Najigram, 3 August 1953, *Stewart & Rahman* 25421 (BM); Hazara distr., Khanpur, 14 September 1957, *Stewart* s.n. (E); Mansehra, Batrasi pass, 28 July 1994, *Schickhoff* s.n. (MSB-152175); Hazara, 18 km SE from Besham, 34°52'N, 72°55'E, 28 August 1995, *Dickoré* 12087 (MSB-152173); Mardan distr., Malakand passs, 34°33'N, 71°55'E,

20 September 1995, *Dickoré* 13353 (MSB-152174); **Punjab province**: Shahpur, 15 September 1902, *Drummond* 14578 (E, K); Peshawar distr., Attock-Nizampur, 12 August 1958, *Burt* 1057 (E).

SAUDI ARABIA: [Jizan region] nr Ad Darb, Abha-Gijan road, 1 November 1985, *Collenette* 5444 (E); [Al Bahah region] Bani Sharfa, 27 November 1966, *M. Mosnier* 2922 (P04934292).

VIETNAM: [Binh Thuan province] Phan-Rang prov., Cana, 24 December 1923, *Poillane* 9318 (K); Quang Ngai province, Dong Phu, June 1934, *Petelot* 5347 (P04601246, P04601249); [Ninh Thuan province] Phan Rang, 15 July 1930, *Poillane* 17872 (P04601247).

YEMEN: Socotra, 4 km SE of Hadiboh, 19 February 1989, *Miller et al.* 8225 (E); Sokotra, Hadiboh Plain, 24 January 1990, *Miller et al.* 10005 (E); [Al Hudaydah Governorate] Hais [Hays], 1837, *M. Botta s.n.* (P04601259); between Wusal al Ali & Beni Muftah, 17 September 1978, *Wood* 2476 (E); [Lahij Governorate] Wadi Labdah, nr At Tur, 17 November 1982, *King* 151 (E).

AFRICA:

ANGOLA: **Benguela province**: Membassoco, February 1942, *Faulkner* A131 (BM, K); **Cuanza Norte province**: Cazengo, December 1854, *Welwitsch* 2398 (BM); Ambaca, June 1855, *Welwitsch* 2397 (BM, K); **Huila province**: Gambos, rio d'Areia, 14 November 1970, *A. Menezes* 3538 (P04583399); **Luanda province**: Luanda, December 1857, *Welwitsch* 2394 (BM); Luanda district, 1903, *M.J. Gosweiler* 247 (P04583543); **Malanje province**: Pungo Andongo, February 1854, *Welwitsch* 2400 (BM, K); **Namibe province**: Mosamedes, Dois Irmaos, 21 February 1956, *Mendes* 1364 (BM).

BENIN: without precise locality, 1904, *Forluo s.n.* (P04583546); between Paoignan and Savalou, January 1902, *M. Poisson s.n.* (P04583577); without precise locality, 1902, *M. Poisson s.n.* (P04583579); near Agouagon, 24 May 1910, *A. Chevalier* 23533 (P04583431, P04583433); Cotonou, 3 April 1962, *D. Froment* 1198 (BR0000017458450); [Abomey-]Calavi, 6 April 1988, *Sinsun* 608 (BR0000000054513, BR0000017458443); Bourguou province, Kalale, 10°15'N, 3°23'E, 380 m, 16 October 1988, *J. Lejoly* 88/194 (BR00000000545171); Davougon, 7°10'N, 1°57'E, 9 October 1996, *M. Ayichedehou* 69 (BR00000000545898); Bourguou, Malanville, Sota, 11°47'N, 3°23'E, 13 November 1998, *V. Adjakidje et al.* 2575 (BR0000017458436); Yaoui (Toui-kilibo), 8°28'N, 2°37'E, 23 July 1999, *Oumorou & Lejoly* 570 (BR00000000546882); Cotonou, 26 July 1999, *F. Genco* 177 (BR00000000559288); Ouidah ("Whydah"), *P.E. Iser* s.n. (C10004313).

BOTSWANA: [North-West District] Kwebe Hills, 4 February 1898, *Lugard* 153 (K); Central distr., Sephope [Sefhophe], 11 February 2006, *Farrington et al.* 0316769 (K); [North-West District] Moremi Game Reserve, 22 February 2008, *Heath* 1537 (K).

BURKINA FASO: Soum, Djibo-Barabole, 4 October 2006, *Carre et al.* 0353348 (K); Ouagadougou/ Sikasso, 25 September 1958, *J.G. Adam* 15436-4 (P00695360);

Axe Djibo-Barabole à 8 km Ouest-Nord, 14°05'55"N; 1°42'34"E, 4 October 2006, *L. Sanou et al.* BUR 451 (P00544385); Zabre, 23 July 1975, *B. Toutain* 1188 (P04583418); Tengongo, 8 km S of Ouagadougou, 12°17'N, 1°31'W, 23 June 1983, *J. Lejoly* 83/251 (BR0000017458337); 22 km N of Banfora, 10°48'N, 4°42'W, 12 June 1983, *J. Lejoly* 83/071 (BR0000017458344); Bale, 10 km E of Boromo, 11°46'N, 2°51'W, 5 August 2005, *van der Maesen et al.* 8026 (BR0000017458351).

BURUNDI (selected specimens): Rutana, 1 March 1960, *Breithof* 19 (BR0000017460835); Bujumbura, 25 January 1967, *Lewalle* 1525 (BR0000017460866, K, M); Bubanza prov., Randa, 3 December 1977, *Reekmans* 6658 (BR0000017460941, K); Bururi prov., Mugara, 27 November 1979, *Reekmans* 8356 (K); Bubanza prov., 21 March 1980, *Reekmans* 8749 (MSB-129433).

CAMEROON: **Adamawa province:** near Koti (50 km SE Banyo), 24 June 1967, *R. Letouzey* 8713 (P04583439); **East province:** Bordoukou, September 1947, *anonym* 1264 (P04583550); **Far North region:** about 5 km W of Maroua, c. 500 m, 2 September 1964, *W.J.J.O de Wilde & B.E.E. de Wilde-Duyffes* 2971 (P04583388, BR0000017458535); 24 August 1964, *Letouzey* 6389 (P04583487); Waza (Sd Maltam), 19 September 1972, *A. Gaston* 3201 (P04583377); Kaele (55 km SSE Maroua), 65 km SW of Kousseri, Kousseri-Waza road, 10 September 1984, *S. Lisowski* B-985 (BR0000017458528); **North region:** Garoua, 7 September 1964, *Bounougou* 114 (K, P04583486); Mayo Alim (52 km S Gouna), 9 December 1964, *J. & A. Raynal* 12406 (P04557321, P04583389); Poli, 28 September 1968, *H. Jacques-Felix* 8385 (P04583513); **West region:** km 18 Bafoussam-Foumbot road, 1 km E of Nchi R., 5°17'24"N, 10°18'36"E, 1000 m, 15 December 1971, *A.J.M. Leeuwenberg* 8903 (BR0000017461092, M; P04583397).

CAPE VERDE: San Nicolau island, 1851, *Bolle s.n.* (K-001134117); Sal, Fogo [Sao Philippe] & Santo Antao Islands, 1875, *Loewe* 37 (BM); Santa Antao island, *Löwe* 37 (K-001134120); Santiago, near Praia, without date and collector (P04583443); [Santiago island] Praia, 29 November 1878, *anonym* 917 (P05196643).

CENTRAL AFRICAN REPUBLIC: [Nana-Mambéré prefecture] Bouar, 1914, *Midbraed* 9385 (BM, BR0000017458559); Bouar, 16 May 1967, *Audru* 3520 (P04583402); [Ouham prefecture] Bossangoa, 12 November 1981, *Fay* 88 (K); [Bamingui-Bangoran prefecture] Dongolo mare, 29 July 1982, *Fay* 2833 (K); [Ouham-Pendé prefecture] Boguila region, 1982, *Fay et al.* 5442 (K); Obo, 27 December 1963, *B. Descoings* 11.954 (P04583495); [Cuvette department] Okoulou, Boundji, 22 June 1965, *A. Bouquet* 1.459 (P04583496); Bambari region, Oubangui, 9 March 1928, *R.P. Tisserant* 2249 (P04583514); Gribingui [river], 29 November 1902, *A. Chevalier* 6387 (P04583434); [Kémo prefecture], Krebedje (Fort Sibut), 7 October 1902, *A. Chevalier* 5640 (P04583435).

CHAD: **Batha region:** Mateti c. Kouki, 28 August 1968, *A. Gaston* 1795 (P04583383); **Chari-Baguirmi region:** Baguirmi, 10-16 August 1903, *A. Chevalier* 9571 (P04583489); **Ennedi-Ouest region:** Mortcha, Koalga, 27 September 1935, *B. Zolotarevsky, M. Murat & L. Dupont* 497 (P04583447); **Logone Occidental re-**

- gion:** Deli, 14 December 1962, *Mosnier 1517* (P04583570); Moundou, 6 December 1964, *Audru 1898* (P04557323, P04557324); Doba, 17 August 1964, *Audru 824* (P04583393); **Kanem region:** Bochoumanga, 12 August 1964, *A. Gaston 324* (P04583450); Touil, 12 August 1964, *A. Gaston 301* (P04583569); **Mayo-Kebbi region:** Koyom, 7 July 1969, *Fotius 1517* (P04583413, P04583425); **Moyen-Chari region:** Moussafoyo, 1 July 1964, *J. Audru 114* (P04583438); c. Moussafoyo, 25 October 1968, *A. Gaston 2307* (P04583384); **N'Djamena region:** Ndjamen, 25 July 1984, *S. Lisowski E-1* (BR0000017458511); **Ouaddai region:** Abeche, 26 June 1966, *A. Gaston 766* (P04583449).
- COMOROS: [no precise location] 1884, *Humboldt 438* (BM, K, P00347334); Johanna [Anjouan] Island, 1875, *Hildebrandt 1685* (BM, K, M, P00500194, WU); Moely [Moheli island], September 1847, *M. Boivin s.n.* (P00500192); Grande Comore island, 26 August 2006, *A. Kaou s.n.* (P00558066)
- COTE D'IVOIRE: **Agnéby-Tiassa region:** N'douci, 20 July 2006, *A. Mangara 218* (BR0000000959397); **Bounkani region:** Bouna National Park, Tehini, 21 August 1964, *R.A.A. Oldeman 287* (BR0000017458313, K, P04583391); Kakpin, 12 August 1967, *G.J.H. Amshoff 711* (BR0000017458290); **Gbêkè region:** Baoule-Nord cercle, between Diahbo and Bouake, 9 July 1909, *A. Chevalier 22077* (P04583469); Bouake, 370 m, 1 June 1962, *A.J.M. Leeuwenberg 4275* (K, P04583386); **San-Pédro region:** Bereby [Grand-Béréby], November 1964, *G.J.H. Amshoff 646* (BR0000017458320, K); **Worodougou region:** 2 June 1909, *A. Chevalier 21823* (P04583488).
- DR CONGO (selected specimens): **Bandundu province:** Lieu, Kikwit, 21 November 1990, *Masens 437* (K, BR0000017459587); **Bas-Congo province:** Moanda, [no date] *Bittremieux 287* (BR0000017458955); Madimba, 13 December 1956, *Carlier 359* (K; M); Songololo, 19 December 1959, *P. Compere 1101* (BR0000017459143); **Équateur province:** Befale, 23 June 1958, *Evrard 4277* (K); **Kasai-Oriental province:** Gandajika, 11 December 1956, *L. Liben 2081* (BR0000017459815); Bakwanga [Mbuji-Mayi], August 1958, *L. Liben 3695* (BR0000017459563); Mweka, 17 June 1958, *Declercq 41* (BR0000017459518); **Katanga province:** Bukama, December 1948, *de Witte 4841* (K); Kongolo, 9 November 1974, *Thompson s.n.* (K); **Kinshasa province:** Leopoldstad [Kinshasa], 1922, *Achten 7* (BR0000017459020); **Kongo Central province:** Matadi, 20 December 1887, *F. Hens 324* (P04583547); **North Kivu province:** plain S of Lake Edward, 1100 m, May-June 1929, *H. Humbert 8193* (P04583509, P04583423); Katanda, September 1937, *J. Lebrun 7726* (P04583549; M); Beni, November 1954, *de Witte 11486* (K); Ndemo, Albert [Virunga] National Park, October 1956, *de Witte 13617* (K); **Orientale province:** Bili, May 1931, *Lebrun 2825* (K, P04583510); Yangambi, October 1936, *J. Vouis 2691* (P04583440); Dungu, Garamba National Park, 2 April 1950, *Noirfalas 115* (K); Opala, 13 November 1976, *S. Lisowski 43281* (BR0000017459969); **South Kivu province:** Ruzizi, 1950, *Germain 5809* (K).
- ERITREA: **Northern Red Sea region:** Assaorta, August 1902, *Pappi 2663* (BM); Archico, 17 January 1952, *Stower et al. 4098* (BM, K); about 45 km on the road

from Massawa to Asmara, 15°35'N, 39°15'E, 300 m, 8 November 1969, *de Wilde* 4656 (BR0000017458580); **Maekel region**: Gahatli, Asmera, 31 December 1987, *Ryding & Edwards* 10222 (K).

ETHIOPIA: **Afar region**: Awash National Park, 12 April 1969, *Gilbert* 1210 (K); Shewa, Awash station, 8°59'N, 40°10'E, 1 August 1975, *P.C.M. Jansen* 2490 (BR0000000569222); **Benishangui-Gumuz region**: between Guba-Mankush & Bambudi, 28 October 2010, *I. Friis & al.* 13628 (BR0000015246189); **Gambela region**: Gambela, 17 May 1976, *Ash* 3419 (K); Gambela, 15 September 1988, *Pavlov* 330 (MW); 17 km E of Punido, along the new road to Gog, 7°33'N, 34°23'E, 24 November 1995, *Friis et al.* 7318 (K; BR0000017458573); **Harar region**: Harar, 17 August 1975, *Gilbert & Thulin* 26 (K); **Oromia region**: Schoa, Wolliso, 1750 m, 1963, *Hildebrandt* 536 (WU); Shoa prov., Wollenchiti [Welenchiti], 17 January 1972, *Gilbert* 2278 (K); Sodere, 12 July 1975, *Gilbert* 3972 (K); about 40 km past Harar on the road to Jijiga, 9°10'N, 42°25'E, 1400 m, 22 March 1977, *de Wilde* 6389 (BR0000017458603; M); Bale region [zone], Sidambale, 10 May 1980, *Thulin et al.* 3502 (K); Bale prov., Dello Mena, 29 May 1988, *Gilbert & Sebsebe* 8527 (K); **SNNPR**: western bank of Omo River, to the E of Nakua volcanic chain, 5°05'N, 36°E, 500 m, 8 July 1972, *R. Bonnefille* 103 (P04583421); Kaffa prov., 5 November 1984, *Gereau* 1387 (K); Gamu-Gofa region, Lower Omo valley, 10 January 1998, *Friis et al.* 8950 (K); **Tigray region**: Ussla valley nr Garrafa, 11 August 1854, *Hohenacker* 2229 (BM, K, P05196646, P04583473).

GABON: [without precise locality], 7 August 1966, *Halle & Thomas* 364 (P04557343).

GHANA: **Greater Accra region**: Accra, 14 March 1927, *Deighton* 583 (K); Prampram, November 1951, *Morton* 6080 (K); Accra, 23 September 1954, *J.O. Ankrab* 20022 (P04583503); Kpong, 10 August 1958, *J. Lebrun* 11329 (BR0000017458368); [Accra], Dome, near Achimota, June 1961, *F.R. Irvine* 5030 (K; BR0000017458375); [Accra], Legon, 6 April 1963, *Dokozi* 381 (MW); **Northern region**: Salaga, 9 July 1920, *Dalziel* 57 (K); Tamale, Nyankpala Station, June 1984, *Abbiv* 47245 (K); **Upper West region**: Kampaha, 2 April 1956, *Adams* 3989 (K); Brong-Ahafo region, near Wenchi farm, 7°46'N, 2°06'W, 250 m, 9 May 1995, *C. Jongkind* 2252 (P04583568, BR0000000515531); **Volta region**: Kpando, 1924, *Robertson* 121 (BM); Adidome, 22 January 1971, *Lewis* 7694 (K); **Western region**: Atwabo, 1931, *Fishlock* 92 (K).

GUINEA: Kouroussa, July 1900, *M. Pobegu* 369 (P04583545); Nzerekore, S of Mt Yonon, 7°58'12"N, 9°03'W, 446 m, 26 April 2011, *C. Jongkind et al.* 10331 (P06807575, BR0000017458252); Kankan, 1 November 1966, *S. Lisowski* 61918 (BR0000017458269).

KENYA (selected specimens): Tsavo Natural Park, 11 April 1966, *Gillett* 17268 (K); **Baringo county**: Baringo distr., 31 October 1964, *Leippert* 5275 (K); Rift Valley, 6 km from Marigat to Kabarnet, 0°28'12"N, 35°58'48"E, 31 October 1964, *H. Leippert* 5275 (WU); [Lake] Bogoria, 25 December 1978, *Lavranos* 17043 (E); **Homa Bay county**: Kobodo, 6 January 2006, *Kirika et al.* 2006/09 (K); **Isiolo**

county: Modo Gash [Mado Gashi], 9 December 1977, *Stannard & Gilbert* 864–889 (K); **Kajiado county:** Mt. Suswa, 4 August 1952, *Verdcourt* 704 (K); Masai distr., 95 km S of Nairobi, 11 March 1977, *Hooper & Townsend* 1323 (K); **Kiam-bu county:** Thika distr., 24 January 1970, *Thulin* 336 (K); **Lamu county:** North Mombasa, way to Lamu & Witu, 1902, *Whyte s.n.* (BM); **Mombasa county:** Mombasa, 1847–1852, *Boivin s.n.* (P04583481); Mombasa, 18 October 1934, *Taylor* 3923 (BM); **Muranga county:** Kora base, Tana river, 31 July 1976, *S.P. Kibuwa* 2437 (BR0000000503254); Kora, 43 miles W of Garissa, 2000 m, 26 July 1976, *Tana River Expedition* 29F2 (BR0000017458658); **Nairobi,** 14 May 1974, *Faden & Ng'weno* 74/566 (K); **Nakuru county:** Lake Elmenteita, 16 June 1951, *Bogdan* 3047 (K); Rift valley, near Eburru, August 1929, *H. Humbert* 9074 (P04583511); **Narok county:** Narok distr., 5 June 1961, *Glover et al.* 1566 (K); **Samburu county:** South Turkana, Kangetet, 16 May 1970, *Matthew* 6221 (K); Ngoronet, 3 December 1978, *Hepper & Jaeger* 7210 (K); **Taita-Taveta county:** Voi distr., Mutanda Rock, 8 February 1953, *Bally* 8797 (K); **Tana River county:** Tana River National Reserve, 13 March 1998, *Luke et al.* 246 (K); Bura, 10 March 1963, *N. Thairu* 58 (BR0000017458665).

LIBERIA: Gbarnga distr., Suakoko, 20 April 1952, *M.L. Blickenstaff* 55 (P04583499, BR0000017458276).

MADAGASCAR: Central Madagascar, August 1880, *Parker s.n.* (K); valle de Manambolo, rive Gauche, environs d'Isomono, Monts Kotriha et Isomonobe, 1933–1934, *H. Humbert* 12836 (P04582864; P04582866); Ranomafana, 20 February 1964, *Peltier* 4748 (P04934053); **Alaotra-Mangoro region:** D'Ambatondrazaka distr., Alaotra Lake, 1918, *Esperandieu* 13 (P05196704); Ambatondrazaka, October 1938, *Cours* 1262 (P04582920); **Analamanga region:** Antananarivo, [no date], *anonym s.n.* (BM); **Androy region:** Ambovombe, 12 July 1931, *Decary* 9074 (P04582892); **Anosy region:** Behara, 3 September 1932, *Decary* 10491 (P04582903); Mandrare, Anadabolava, December 1933, *Humbert* 12403 (BM, P04582867); Fort Dauphin [Tolanaro], 1955, *Humbert & Capuron* 29035 (P04582854); **Atsimo-Andrefana region:** Tulear prov., nr Beza Mahafaly Reserve, 6 January 1988, *Phillipson* 2800 (K); **Atsimo-Atsinanana region:** Tulear, January 1947, *Humbert* 19845 (P04582859); Ankazoabo, February 1967, *Morat* 2550 (P04582851); Toliara prov., Tulear to St. Augustin, 5 January 1999, *De Block et al.* 551 (P05196702); **Boeny region:** Mahajanga (Majunga), Ambalabao, 12°48'S, 49°14'E, 350 m, 13 March 1988, *Cheek et al.* 1471 (P05196699); **Diana region:** Nosy Be Island, May 1879, *Hildebrandt* 2974 (BM, M); **Ihorombe region:** Fianarantsoa, Iakora, 7 February 2005, *Andrianjafy* 977 (P05196701); **Fianarantsoa region:** 21°50'11"S, 46°50'17"E, 15 March 2010, *Rakotoarivelo et al.* 241 (P06807565); **Melaky region:** Tsingy de Bemaraha, north of Manambolo river, 19°9'S, 44°49'E, 50 m, 3 December 1996, *C.C.H. Jongkind* 3361 (BR0000000555590, P05196710).

MALAWI: **Central region:** Chitala, 12 February 1959, *Robson* 1552 (BM); **Southern region:** Shire Highlands, 6 April 1906, *Adamson* 125 (K, P04583482); Port Her-

ald [Nsanje], 260 m, 19 March 1960, *J.B. Phipps* 2557 (BM, BR0000017458900); Zomba, Nselema village, 23 April 1965, *E.A. Banda* 87 (BR0000017458894); South prov., 14 April 2008, *Chapama et al.* 817 (K).

MALI (selected specimens): **Bamako**, June 1929, *Waterlot* 1199 (P04583471); **Gao region**: Gao, 12 September 1927, *Hagerup* 334 (BR0000017458191, K); Tabankort, 28 August 1931, *A. Leclercq* 42.647 (P04583461); Menaka, 27 November 1932, *A. Leclercq* 813 (P04583459, P04583463); Gao, 1 July 1935, *de Wailly* 4704 (P04583457); **Kayes region**: 5 km E Macina (c. Nioro), 22 October 1969, *G. Boudet* 5973 (P04583373); **Kidal region**: Adrar [Adrar plateau], September 1969, *Popov* 69/29 (BM); Adrar des Ifoghas, September 1985, *Sidiyene* 9 (P04583566); **Koulikoro region**: Katibougou, 2 July 1967, *Kaden* 257 (MW); Koulikoro, 13 June 1977, *Aberlin* 73 (P04583390); **Mopti region**: Ngouma, 20 October 1971, *G. Boudet* 7311 (P04583375); Nema, 2 August 1933, *anonym s.n.* (P04583452); Dallah, 19 June 1932, *J. Rogeon* 378 (P04583458); Bandiagara, 11 June 1932, *J. Rogeon* 343 (P04583460); Boni, 21 June 1899, *anonym s.n.* (P04583465); **Ségou region**: San, 29 June 1899, *A. Chevalier* 1077 (P04583467; BR0000017458207); Farabougou, 8 July 1933, *anonym s.n.* (P04583453); Dioura, August 1954, *Davey* 77 (K); **Sikasso region**: Sikasso, 29 October 1964, *Andronova* 16 (MW); Sanzana, 7 July 1970, *N. Diarra* 644 (P04583557); **Tombouctou region**: Karouassa, 30 June 1909, *M. Chudeau s.n.* (P04583472); Tilemsi, 15 September 1959, *Rossetti* 144 (P04583559).

MAURITANIA (selected specimens): **Assaba region**: Tahmeire, Sortie Sud de Kiffa sur la route de Kankossa, 16°32'47" N, 11°24'9" E, 9 September 2008, *J.-N. Labat et al.* 3957 (P00577618); **Brakna region**: between Bassi Nguidi and Mal, 10 October 1960, *M. Mosnier* 7487 (P04583562); **Gorgol region**: Rinndiao, 1972, *Naegele s.n.* (K); Maghana, 22 August 1986, *Barriere* 45 (P05196644); **Trarza region**: Tamzak, 19 October 1963, *J.G. Adam* 19389-4 (P00694379, P00695683); **Tagant region**: Letfatar, 26 October 1910, *M. Chudeau s.n.* (P04583502); Moudjeru [Moudjeria], 24 June 1911, *M. Chudeau s.n.* (P04583501); Nbeika, 27 September 1997, *G. Heynemann* 2940 (BR0000000938991).

MAURITIUS: Morne Brabant [Peninsula], 23 February 1973, *Gueho* 15575 (K).

MOZAMBIQUE: **Manica province**: Manika & Sofala, Chimoio, 23 February 1948, *Garcia* 324 (K); Dombe, Machonga, 23 November 1965, *A. Pereira & A. Marques* 834 (BR0000017458924); **Nampula province**: Erati, Namapa, 21 March 1961, *Balsinhas & Marrime* 304 (BM, K); **Sofala province**: Gorongosa prov. [district], 16 May 1906, *G. Vane* 368 (P04583483); Gazaland, Madanda forest, 5 December 1906, *Swynnerton* 2762 (BM); Chemba, November 1926, *M. Surcouf s.n.* (P04583448); **Tete province**: Tete, ca. 350 m, 5 February 1970, *A.R. Torre & M.F. Correia* 17824 (P04583380); **Zambezia province**: Boroma, February 1890, *Manyharth* 921 (WU); Cundine, 24 November 1908, *M. le Testu* 884 (P04583533).

NAMIBIA: **Erongo region**: 18 January 1934, *Dinter* 6850 (BM); Karibib, Farm Ameib, 20 March 1963, *Giess et al.* 5870 (M); Karibib, 22 March 1965, *Toelken & Hardy* 779 (K); Ameib, 22 March 1965, *Toelken & Hardy* 779 (K); **Oshana region**: Oka-

psa, nr Ondangua, 8 February 1959, *de Winter & Giess* 6900 (M); **Otjozondjupa region**: Erichsfelde, Eckenberg, 23 March 1956, *Volk* 11910 (M); Otjiwarongo distr., Farm Okamuru, 5 March 1974, *Merxmüller & Giess* 30083 (M); Grootfontein, Farm Kumkauas, 11 March 1974, *Merxmüller & Giess* 30225 (M).

NIGER (selected specimens): **Agadez region**: Ighazer plain nr Agades, 9 September 1965, *Popov* 35 (BM); **Maradi region**: Dakoro Ranch, 9 August 1985, *Pase* 3110 (K); **Niamey**, July 1975, *P. Lavie* 913 (P04583558, P04583561); **Tahoua region**: Ekrafane, 6 September 1986, *Peyre de Fabregues* 4351 (P05196645); Ekrafane, 25 July 1979, *Klein* 717 (P04583415); Tahoua, September 1961, *J. Koechlin* 6639 (P04583454); **Téra department**: Kolo, 25 May 1942, *A. Marchal s.n.* (P04583405); **Tillabéri region**: Filingue, Toukounous, September 1961, *J. Koechlin* 6577 (P04583451); Filingue, 19 August 1985, *H. Breyne* 6117 (BR0000017458467); Baleyara-Filingue road, Tabla, 23 August 1987, *N. Leman* 157 (BR0000017458474); **Zinder region**: Goure, 31 July 1964, *Peyre de Fabregues* 556 (P05196647, P05196648).

NIGERIA: **Adamawa state**: Yola, 19 July 1909, *Dalziel* 51 (K); **Anambra state**: Onitsha, 3 May 1944, *Onochie* 7526 (K); Vogel Peak area, Dawo, 520 m, 19 November 1957, *Hepper* 1408 (K, P04583508, BR0000017458542); **Bauchi state**: Katagum distr., 9 July 1907, *Dalziel* 195 (K); River Benue, September 1910, *Talbot s.n.* (BM); Bichiki, 17 May 1921, *Lely* 181 (K); **Borno state**: Dikwa, 13 December 1954, *McClintock* 103 (K); **Edo state**: Okomu Forest reserve, 31 December 1947, *Brenan & Jones* 8636 (BM, K, P04583493); Benin city, 31 December 1947, *J.P.M. Brenan* 8636 (BR0000017458504); **Kogi state**: Kabba prov., Igala distr., between miles 6&7 of Idah-Nsukka motor road, 8 June 1963, *M.G. Latilo* 47675 (K, P04583382); **Kwara state**: Lokoja distr., 22 April 1979, *Daramola* 90187 (K); **Lagos state**: Lagos, 8 April 1909, *Dennett* 497 (K); **Niger state**: [New] Bussa, 25 July 1965, *Cook* 389 (K); **North-West state**: Kuje distr., 18 May 1973, *Eimunjeze et al.* 66438 (K); **Ogun state**: Oru, 1931, *Lebrun* 3585 (K); **Osun state**: Ilesha, Ipole, 11 June 1977, *Lowe* 17554 (K); **Oyo state**: Iseyin rocks, 18 October 1969, *Jackson & Etukudo* 8181069 (P04583381); Ibadan, 26 July 1961, *Swarbrick* 2486 (E).

REPUBLIC OF CONGO: [Bouenza Department] Loudima, 12 May 1979, *Bonnin* 401 (K); Brazzaville, July 1908, *A. Chevalier* 4188 (P04583494); Brazzaville, November 1884, *M. Thollon* 919 (P04583553); Ngatsou, 55 km NE of Brazzaville, 13 July 1985, *G. Cusset* 1389 (P04583565).

RWANDA: [Eastern province] Kibungu, 10 April 1958, *Troupin* 6962 (K, BR0000017460828); [Harare province] Bitshumbi, 1933, *G. de Witte* 1030 (P04583548).

SENEGAL (selected specimens): **Dakar**: 18 September 1930, *J. Trochain s.n.* (P04583442); environ Dakar, 7 August 1948, *J.G. Adam* 1678 (P00695351); Alamadies, 2 October 1955, *J.G. Adam* 10958 (P00695339); **Diourbel region**: Bambey, 13 December 1960, *J. & A. Raynal* 6680 (P04583430); **Kaolack region**: Kaolack, 1950–1951, *R.P. Berhaut* 401 (P04583551); **Kédougou region**: Niokolo-Koba, 12 June 1958, *J.G. Adam* 14.345 (P04583484); **Louga region**: Lagbar, 18

- September 1956, *J.G. Adam* 12344 (P00695336); Gallayel, 8 September 1965, *M. Mosnier* 2232 (P04583392); **Saint-Louis region**: near Dagana, July 1828, *Le-prieur s.n.* (P04583582); Ross-Betio [Ross Bethio], 25 August 1965, *Audru* 2281 (P04583396); Dagana, 12 October 1969, *Hepper* 3642 (K); Fete-Ole, 15 October 1976, *A. Cornet* 536 (P04583398); NE of Lac de Guiers, 16°20'N, 15°45'W, 22 November 1984, *P. Bamps* 7596 (BR0000017458153); **Tambacounda region**: Tambacounda, 1 October 1988, *C. van den Berghen* 8188 (BR0000017458177); **Thies region**: Thies, 5 November 1939, *Adam* 8944 (M); Nianing, 16 August 1954, *R.P. Berhaut* 5370 (P04583491); **Ziguinchor region**: Basse-Casamance [National Park], October 1988, *C. Vanden Berghen* 8188 (BR0000017458177).
- SIERRA LEONE: Sierra Leone, 1798, *Afzelius* (LINN-HS 152.3); **Eastern province**: Njala, 25 September 1926, *Deighton* 2119 (K); **Northern province**: nr Falaba, 31 March 1892, *Scott Elliot* 5423 (K); Makeni, 31 August 1928, *Deighton* 1276 (K); Makump, 4 May 1929, *Deighton* 1413 (K); Rokupr, 20 February 1950, *Jordan* 382 (K).
- SOMALIA: **Bay region**: Bur Akaba [Buur Hakaba], *Gillett Hemming* 24893 (K); Buur Heybe, 1985, *O'Brien s.n.* (K); Durdur, 1 June 1989, *Thulin & Mohamed* 6759 (K).
- SOUTH AFRICAN REPUBLIC: **KwaZulu-Natal province**: Zululand, 8 December 1971, *Pooley* 1552 (E; M); **Limpopo province**: Waterberg distr., 3 March 1925, *Galpin* 153 (K); Dongola Reserve, 15 March 1948, *Codd* 3845 (K); Transvaal [Limpopo] prov., Kruger National Park, 4 February 1949, *Codd & de Winter* 4983 (K); Transvaal, Soutpansberg, 31 January 1962, *Schlieben* 9279 (K); Malalane, Kamatipoort [Komatipoort], 20 January 1966, *Hilliard & Burt* 3613 (E); Messina [Musina], 8 January 1974, *Pienaar* 283 (K); **Mpumalanga province**: Komatipoort, December 1917, *Moss* 607 (BM).
- SOUTH SUDAN: Gondokoro, February 1910, *Mearns* 3058 (BM); Mongalla, Bahr el Gebel, 7 July 1929, *Simpson* 7279 (K, BM); S Sudan, 50 miles S of Rejaf, Gumbiri, September 1929, *Edwards s.n.* (BM); Bo river, 22 July 1937, *Myers* 7313 (K); Zande Land, [Khor] Uze, 12 April 1939, *Wyld* 500 (BM); Anglo-Egyptian Sudan, Torit, 4°94'N, 32°34'E, 24 June 1949, *Jackson* 831 (BM).
- SUDAN: [Kordofan state] Cordofan Mt., 3 October 1839, *Kotschy* 119 (BM, BR0000017458566); Kordofan, 1837/1839, *Kotschy s.n.* (M-7419); Darfur province [region], 1000-1100 m, 1 January 1934, *Dandy* 24 (BM); [Khartoum state] Omdurman, 10 November 1954, *Jackson* 3229 (K).
- TANZANIA (selected specimens): **Arusha region**: Lake Manyara, 15 June 1965, *Greenway & Kanuri* 11860 (K); **Dodoma region**: Bahi, 3000 ft, 23 April 1962, *Polhill & Paulo* 2132 (K, BR0000017458801); **Kilimanjaro region**: Lake Chala crater rim, 3°19'12"S, 37°40'48"E, 8 January 2004, *A. Hemp* 4242 (WU); **Lindi region**: 25 km S of Lindi, 280 m, 3 January 1935, *Schlieben* 5926 (BM, P04583538, BR0000017458825); **Mara region**: Serengeti, Kirawira plain, 900 m, 27 April 1965, *Richards* 20298 (K; BR0000017458757); **Morogoro region**: Mbanga, 700 m N of Mahenge station, 22 February 1932, *H.J. Schlieben* 1821 (P04583522, BR0000017458818); Mahenge, Ubangala, 22 February 1932, *Schlieben* 1821 (BM);

- Tanganyika, Morogoro, 2000 ft, March 1935, *E.M. Bruce* 926 (P04583534); Morogoro distr., November 1953, Semsei 1425 (K); Mbulu distr., Tarangire Nat. Park, road to Burungi Lake, 1066 m, 13 November 1970, *M. Richards* 25439 (BR0000017458764, M); Mlali valley, Ngerengere, near Madanganya, 550 m, 25 February 1970, *T. Pocs* 6135/D (BR0000017458689); Mbulu distr., Iringa distr., Kidatu, 5 February 1971, *Mhoro* 473 (K); **Rukwa region**: Sumbawanga distr., Muse, 29 December 1961, *Robinson* 4809 (K); **Ruvuma region**: Songea distr., Mbamba Bay, 460 m, 5 April 1956, *E. Milne-Redhead* & *P. Taylor* 9522 (K, BR0000017458795); **Shinyanga region**: Nyika, July 1894, *R.P. Sacleux* 2183 (P04583540); Shynianga, 25 February 1950, *Weloh* 26 (K); **Tanga region**: Lushoto distr., 29 April 1953, *Drummond* & *Hemsley* 2274 (K); Muheza distr., 4 May 1987, *Iversen et al.* 87197 (K); on the road between Bagamoyo and Msata, 6°25'48"S, 38 54'E, 17 December 2004, *A. Hemp* 4222 (WU); **Zanzibar**, May–June 1883, *M.G. Revoil* s.n. (P04583479).
- TOGO: **Kara region**: Kpagouda, 10 May 1980, *H. Scholz* 870 (K); **Maritime region**: Lome, 1900–1902, *Warnecke* 6 (BM, K, P04583527, BR0000017458412); Lilikope, 6°34'N, 1°11'E, 22 July 1977, *F.J. Breteler* 7023 (BR0000017458382); Lome to Cacaveli, 14 April 1978, *Hakki et al.* s.n. (B); **Plateaux region**: Klouto [Kloto], 10 September 1973, *Hiepko* & *Schultze-Motel* 150 (K, P04583417); Atakpame, 18 September 1973, *Hiepko* & *Schultze-Motel* 257 (K, P04583416).
- UGANDA (selected specimens): **Central region**: Singo co., Wattuba, 13 April 1970, *Katende* 103 (K); Mukono, Kyagwe, 20 March 1992, *Rwaburindore* 3395 (K); North Buganda, Mukono, Kyagwe, Bule-Buyaga, 0°17'S, 32°42'E, 1200 m, 20 March 1992, *P.K. Rwaburindore* 3395 (BR0000017458610); **Eastern region**: Busoga distr., 17 April 1953, *Wood* 724 (K); **Kampala**, [no date] *Liebenberg* 839 (K); **Western region**: Toro distr., 24 December 1934, *Taylor* 2655 (BM); Ruwenzori, *Scott Elliot* 6232 (BM).
- ZAMBIA: **Central province**: Chitala, 12 February 1959, *Robson* 1552 (K); **Eastern province**: near Changwe, between Petauke & Mwape, 650 m, 16 December 1958, *N. Robson* 959 (BM, K, BR0000017458870); Luangwa valley, Game Ras, 21 February 1967, *Prince* 292 (K); Mopane woodland, North Luangwa National Park, 17 March 1994, *Smith* 446 (K); **Southern province**: Victoria Falls, south bank of Zambezi, 12 February 1912, *Rogers* 5701 (BM); Kalomo, 16 February 1965, *Fanshawe* 9112 (K); Gwembe distr., Changa, 12 February 1973, *Kornash* 3258 (K).
- ZIMBABWE: **Manicaland province**: Sabi valley, Nyanyadzi, 1800 ft, 3 February 1948, *H. Wild* 2494 (BR0000017458917); Nyanga distr., 29 November 1959, *Goodier* 686 (K); **Mashonaland West province**: Urungwe, 29 January 1958, *Drummond* 5326 (K); **Masvingo province**: Nuanetsi, 8 May 1958, *Drummond* 5702 (K); Chibi distr., 29 December 1962, *Moll* 358 (E); **Matabeleland South province**: Beitbridge, 22 March 1967, *Mavi* 280 (K); Insiza, 8 February 1974, *Mavi* 1522 (K); **Midlands province**: Queque [Kwekwe], 1 May 1976, *Dye* 473 (K).