

Taxonomic notes on the genus *Neorautanenia* (Fabaceae–Phaseoleae)



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Background: *Neorautanenia* is a small genus in the subtribe Glycininae within the tribe Phaseoleae in the family Fabaceae. It is distributed in southern and Tropical Africa. Historically, the genus is known to consist of three species, namely, *N. brachypus*, *N. ficifolia* and *N. mitis*; morphological data suggest that these should be reduced to two.

Objectives: The aim of this article is to formally sink *N. brachypus* into the synonymy of *N. mitis* and to provide the correct typification, diagnostic features, diagnostic key, distribution maps, as well as illustrations of the morphological features of the two species.

Methods: Observations were made on herbarium specimens housed at PRE. Morphological features were studied and measurements of characters recorded.

Results: *Neorautanenia mitis* is extremely variable morphologically, so that several authors recognised many different variants, some of these as distinct species, including *N. brachypus*. Examination of numerous specimens, however, indicates that these are merely morphological and/or geographical variants of *N. mitis*. This observation prompted Verdcourt to place this taxon as a synonym of *N. mitis*; however, he reversed that decision 30 years later. It has become necessary to revert to the original decision.

Conclusions: *Neorautanenia brachypus* is formally reduced to a synonymy of *N. mitis* and as a result the genus comprises only two species.

Keywords: *Glycininae*; taxonomy; nomenclature; morphology; type specimen.

Introduction

The small African genus *Neorautanenia* Schinz was erected by Schinz (1899) to accommodate a single species *N. amboensis* Schinz, which he had collected in Namibia. The genus was named for Reverend Martti Rautanen (1845–1926), who was a Finnish missionary and botanist in Namibia (Schrire 2005), and is currently placed in the subtribe Glycininae. Hutchinson (1964) placed *Neorautanenia* in his tribe Phaseoleae as opposed to Glycinae. The pantropical subtribe Phaseolinae is characterised by the standard petal that usually has 2(4) or 1 large appendages on the face, as well as a bearded style (Lackey 1977; Moteetee & Van Wyk 2011). Despite the style lacking a beard in *Neorautanenia*, Lackey (1977) left it (together with the genus *Otoptera* DC.) in the Phaseolinae stating that their affinities were not clear and that neither seemed to fit anywhere else. Based on molecular sequences of the chloroplast gene region *rbcL* and morphological data, Doyle et al. (2000) and Kajita et al. (2001) showed that *Neorautanenia* does not belong to subtribe Phaseolinae. These results supported Lackey's (1981) earlier observation that the genus was an anomalous member of this subtribe. Another molecular phylogenetic study based on *matK* and ITS DNA sequences (Delgados-Salinas et al. 2011) confirmed the exclusion of the genus from the Phaseolinae. All these studies firmly placed the genus within subtribe Glycininae. Unlike in the Phaseolinae, in members of the Glycininae the style is not bearded and the standard petal has no appendages. However, even within this subtribe, the generic affinities of *Neorautanenia* are still not clear. The genus is widespread in tropical West and East Africa, spreading southwards as far as Namibia, Botswana and South Africa. It is traditionally divided into three species (i.e. *N. amboensis*, *N. ficifolia* (Benth.) C.A.Sm. and *N. mitis* (A.Rich.) Verdc.), after Verdcourt (1970) sunk *N. brachypus* into synonymy with *N. amboensis*. Later on, Verdcourt (2001) resurrected the former species and placed *N. amboensis* into synonymy with *N. mitis* instead. He then went on to point out that 'to sink all the three taxa here into one would possibly not be acceptable to workers in South Africa'. The aim of this article is therefore to again sink *N. brachypus* into *N. mitis* as a taxonomic synonym and to provide the correct typification of the species and their distribution ranges in southern Africa.

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Materials and methods

Plant material was studied mainly from the rich collection of herbarium specimens housed in PRE. The morphology of the leaves and flower was examined under a dissecting microscope. Flowers were rehydrated in boiling water for 5 min, dissected under a binocular stereomicroscope and mounted in glycerol on a microscope slide for observation. Camera Lucida was used to draw the reproductive and vegetative morphology of the plant species. Information on the distribution of the species was gathered from herbarium material and recorded using the Quarter Degree Reference System (Edwards & Leistner 1971; Leistner & Morris 1976). The basic unit in this system is the 1-degree square of latitude and longitude, which is designated by a degree reference number (i.e. degrees of latitude and longitude of the north-west corner) and the district name of that square. Habit affinities are described according to Mucina and Rutherford (2006).

Taxonomic treatment

Neorautanenia Schinz in Bull. Herb. Boiss. 7: 35 (1899); C.A.Sm. in Burtt Davy, Flowering Pl. Ferns Transvaal 2: 416 (1932); Verdc.: 300 (1970); Gillett et al.: 699 (1971); Thulin: 140 (1983); Verdc.: 74 (2001); Schrire in Lewis et al., Legumes of the World: 417 (2005). Type species: *N. amboensis* Schinz.

Dolichos L. section *Pseudopachyrhizus* Harms, Pflanzenw. Afr. 3, 1: 679 (1894).

Prostrate or climbing herbs, rarely erect subshrubs; young stems and leaves densely silky hairy. Leaves pinnately trifoliate, blue-green with yellow veining, petiolate, stipulate; leaflets erratically tri-lobed to subentire, rhombic-obovate, rhombic-lanceolate, stipules narrowly oblong-lanceolate to lanceolate, striated, 5–11 × 1–5 mm; petiole (15)30–60 mm long, terminal leaflet petiolule (2–10)20–30 mm long. Bracts caducous; bracteoles absent. Inflorescences axillary racemes, many-flowered, peduncles (90)130–290(310) mm long; flowers purplish blue, 7–14 mm long. *Calyx* bilabiate, upper lip bifid, lower lip trifid, two upper lobes partly joint, lowermost lobe the longest, acute, appressed pubescent or densely villous. *Corolla* persistent; *standard* dark blue to mauve inside and greyish outside, 8–12 × 7–10 mm, without appendages, glabrous, obovate, with a linear claw; *wings* obovate, with surface sculpturing, with a large, oblong spur at the base, glabrous; *keel* obtuse, glabrous, slightly smaller or more or less equal to the wing, glabrous. *Stamens* diadelphous with 9 filaments fused and the vexillary stamen free. *Ovary* narrowly oblong, stipitate, pubescent, 4–6-ovuled; style curved upwards, glabrous; stigma capitate. *Pods* linear-oblong to oblong-cylindrical, septate between the seeds, 40–100 × 10–20 mm, (1)4–6-seeded; densely covered in short and longer hairs, dehiscent. *Seeds* black or dark blackish grey.

Key to species of *Neorautanenia*:

Leaflets roughly hairy and subvillous, always lobed (with 3–5 lobes), with prominent ribs and veins on the lower surface.....*N. ficifolia*

Leaflets silky-hairy, entire, sub-entire, or lobed (with 3 lobes), but if 3–5-lobed, the ribs and veins not prominent *N. mitis*

N. mitis (A.Rich.) Verdc., Common Poisonous Pl. E. Afr.: 89 (1969); & in Kew Bull. 24: 306 (1970); Schreiber, in Merxmüller, Prodr. Fl. SW. Afrika, fam. 60: 92 (1970); Verdc. in F.T.E.A., Leguminosae, Pap.: 700 (1971); *Dolichos mitis* A.Rich., Tent. Fl. Abyss. 1: 224 (1847). Type: Ethiopia, 'Abbyssinia, crescit circa Add'erbati in regno Tigré [Tigray]', no date provided, *Quartin-Dillon s.n.* sub P00374519 (P, holo.).

Pachyrhizus orbicularis Welw. ex Bak. in Fl. Trop. Afr. 2: 208 (1871). *Dolichos orbicularis* (Bak.) Bak. f., Leg. Trop. Afr. 2: 451 (1929). *Pachyrhizus? orbicularis* Welw. ex. Baker in Fl. Trop. Afr. 2: 208 (1871). *Neorautanenia orbicularis* (Bak.) Torre in Bol. Soc. Brot., sér. 2, 39: 216 (1965). Type: Angola, Highlands of Pungo Andongo, Jan. 1857, *Welwitsch 2184* (LISU, lecto.!, designated here, see taxonomic note (i); LISU, isolecto.!).

Dolichos pseudopachyrhizus Harms in Engl., Bot. Jahrb. 26 (3–4): 320 (1899). Type: Sudan, 'Seriba Ghattas', Jul. 1869, *Schweinfurth 2048* (B†; K, lecto.!, designated here, see taxonomic note (ii)); Other original material: Sudan, 'Kurschuck Ali's Seriba', May 1869, *Schweinfurth 1728* (K!). *Neorautanenia pseudopachyrhiza* (as '*pseudopachyrhiza*') (Harms) Milne-Redh. in Kew Bull. 5: 355 (1951). Type as above.

D. pseudopachyrhizus Harms var. *subintegrifolius* Harms in Engl., Bot. Jahrb. 26 (3–4): 322 (1899). Type: Eritrea, 'Donkollo, Höhe bei Ghinds und am Abhang nach Norden gegen Sabarguma [Sabarguma]', Feb. 1891, *Schweinfurth 119* (B†; M, lecto.!, designated here, see taxonomic note (iii)). Other original material: Ethiopia, 'bessinien, Ebene Hamedo, an Bäumen kletternd', Sept. 1862, *Schimper 140* (B†; BM!).

D. pseudopachyrhizus Harms var. *kilimandscharii* Harms in Engl., Bot. Jahrb. 26 (3–4): 322 (1899). Type: Tanzania, 'Steppe zwischen Meru und Kilimandscharo [Kilimanjaro], unterhalb Schira', Dec. 1895, *Volkens 1614* (B†, BM, lecto.!, designated here, see taxonomic note (iv)).

Neorautanenia amboensis Schinz in Bull. Herb. Boiss. 7: 35 (1899). Type: Namibia, 'Südwest-Afrika: Amboland [Ovamboland], Omatope bei Olukonda (Oshihekeformation), Jan. 1886, Schinz s.n. (Z, lecto.!, here designated, see taxonomic note (v)). Other original material: Namibia, 'Hereroland', between Dec. 1885 and Feb. 1886, *Lüderitz 7a* (Z, syn.!).

Dolichos brachypus Harms in Engl., Bot. Jahrb. 26: 323 (31 Jan. 1899). *Neorautanenia brachypus* (Harms) C.A.Sm. in Burtt Davy, Flowering Pl. Ferns Transvaal 2: xxvii & 418 (1932). Type: South Africa, Mpumalanga, 'Komatipoort', Dec. 1897, *Schlechter 11869* (BR, lecto.!, here designated, see taxonomic note (v); BM!, K!, P!, isolecto.).

Dolichos ellenbeckii Harms in Engl., Bot. Jahrb. 33: 177 (1902). *Neorautanenia pseudopachyrhiza* (Harms) Milne-Redh. var.

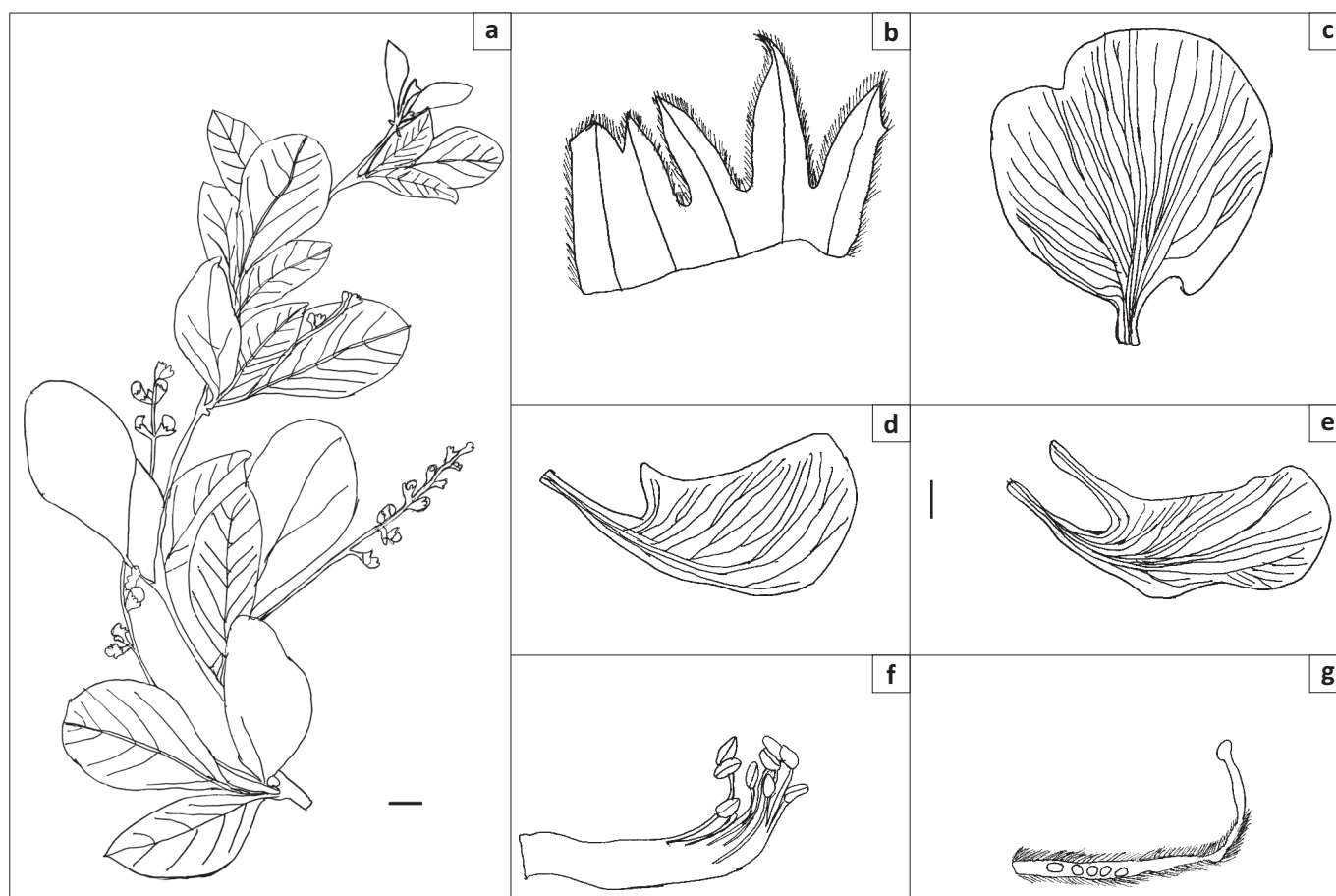


FIGURE 1: Vegetative and floral morphology of *N. mitis*. (a) Flowering branch; (b) calyx opened out with upper lobes to the left; (c) standard petal; (d) keel petal; (e) wing petal; (f) stamens; (g) pistil. Scale bars: (a) 10 mm; (b–g) 2 mm. Vouchers: (a) *E. Wyers* s.n. PRE53223 (PRE); (b–g) *P.A. Smith* 2168 (PRE).

ellenbeckii (Harms) Cuf., Enum. P1. Aeth. Sperm.: 315 (1955). Type: Ethiopia, 'Gallaland: Arussi Galla', *Ellenbeck* 1387 (B†, not seen). [Synonymy follows Verdcourt (1970)]

Galactia lugardii N.E.Br. in Bull. Misc. Inf. Kew 1909: 104 (1909). *Neorautanenia lugardii* C.A.Sm. in Burt Davy, Flowering P1. Ferns Transvaal 2: xxvii & 417 (1932). Type: 'Ngambiland' [Botswana], Kwebe, *Lugard* 61 (not seen, see taxonomic note (vi)). [Synonymy follows Verdcourt (1970)]

Dolichos seineri Harms in Notizbl. Bot. Gart. Berl. 5: 206 (1911). *Neorautanenia seineri* (Harms) C.A.Sm. in Burt Davy, Flowering P1. Ferns Transvaal 2: xxviii & 418 (1932). Type: Botswana, 'Brit. Bechuanaland: Struchsteppe südlich der Mabule a puli-Berge', *Seiner* 322 (B†, not seen). [Synonymy follows Verdcourt (1970)]

Pueraria rogersii L.Bolus in Ann. Bolus Herb. 1: 189 (1915). *Neorautanenia rogersii* (L.Bolus) C.A.Sm. in Burt Davy, Flowering P1. Ferns Transvaal 2: xxviii & 417 (1932). Type: South Africa, Mpumalanga, between Komatipoort and Letaba River, date not provided, *Rogers* 11806 (not seen, see taxonomic note (vii)). [Synonymy follows Verdcourt (1970)].

Neorautanenia coriacea C.A.Sm. in Burt Davy, Flowering P1. Ferns Transvaal 2: xxvii & 417 (1932). Type: South Africa, Limpopo, Naboomspruit, Apr. 1924, *Hahn* H8128 (PRE, holo.).

Neorautanenia edulis C.A.Sm. in Burt Davy, Flowering P1. Ferns Transvaal 2: xxviii & 418 (1932). Type: South Africa, Limpopo, near Naboomspruit, farm Geluk, 10 Jan. 1925, *Galpin* 583 (PRE, holo.).

Sub-erect, scrambling or occasionally prostrate perennial herb up to ca. 10 m long, with prostrate stems, growing from a large underground tuber. Young stems and foliage covered with dense silvery-grey silky hairs and older stems characteristic pale yellowish-brown, covered with sparse, appressed microscopic hairs. Terminal leaflet 45–120 × 20–60(100) mm; lateral leaflets 42–92 × 22–38 cm, rhombic-obovate, rhombic-oblongate, oblanceolate when young, may be entire when young and forms 3 lobes when mature; lateral lobes somewhat asymmetric, more or less densely silky. Petioles 25–60(90) mm long; terminal leaflet petiolules 2–5 mm long; stipules 5–7 × 1–3 mm, stipels 1–5 mm long. Inflorescences (90)130–270(310) mm long; flowers 8–14 mm long. Calyx appressed pubescent; tube 2–3 mm long, upper lobes 3–5 mm long, carinal lobes 6–8 mm long, lateral lobes 3–6 mm long. Standard 9–11 × 7–1 mm, broadly obovate, claw 1–3 mm long; wing 10–12 × 3–6 mm, claw 2–4 mm; keel more or less equal to the wing, ± 12 × 4–6 mm, claw 2–4 mm long. Gynoecium 4–7 × 0.5–1 mm long. Pods swollen, 65–100 × 10–14 mm, (1)4–6-seeded, seeds 8 × 7 mm (Figure 1). Flowering time: December–June.

Distribution and ecology

Neorautanenia mitis occurs in Namibia, Botswana, and in the Limpopo, Gauteng and Mpumalanga provinces of South Africa (Figure 2), in open and wooded grassland on Kalahari sand and other sandy soils.

Taxonomic notes

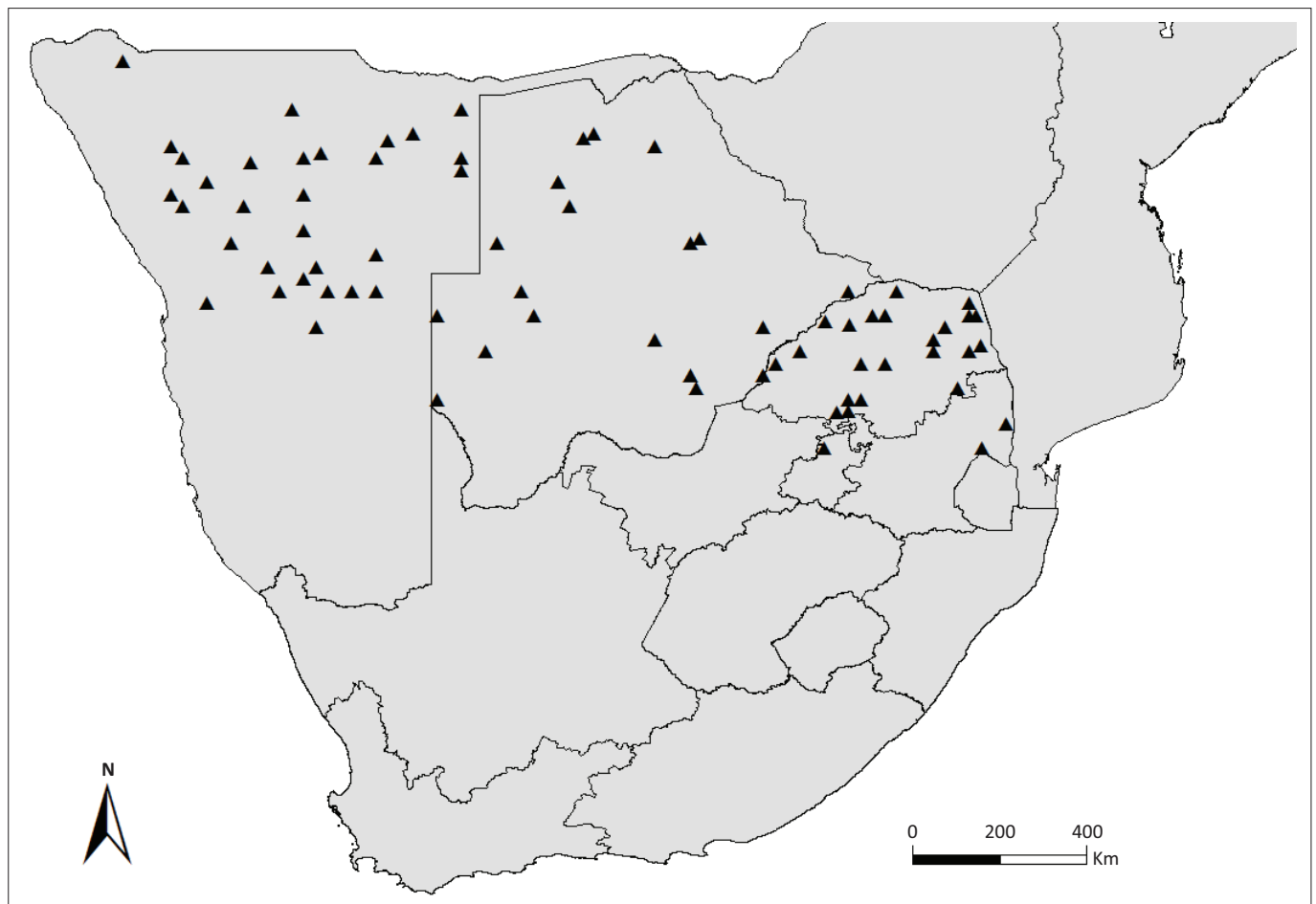
(i) The LISU specimen with the barcode LISU208829 is selected because it has flowers. (ii) The sheet in K has two specimens of *D. pseudopachyrhizus*. The upper specimen, with the label K000263664, is chosen because it has flowers. (iii) The specimen in M is chosen because it is a more complete specimen, having both flowers and pods. (iv) The specimen in BM is chosen as lectotype because it is the only one available. (v) Schinz's specimen is chosen because it has a label from his herbarium with locality details, probably handwritten by him. (vi) Since no original material is available in B (where Harms was based), the BR specimen is chosen. (vii) Despite the fact that Verdcourt (2001) referred to two specimens housed in K, they could not be located. (viii) One would have expected this type specimen to be lodged at BOL because Louisa Bolus worked there, but the specimen could not be located; it is also not lodged at K.

Diagnostic characters

This species exhibits extreme morphological variation in terms of leaflet structure and shape, with a number of intermediates ranging from entire (rhombic-obovate, rhombic-oblancoolate, oblanceolate) to 3-lobed (Figure 3b–c). As a result, several of these variants have been described as different species. These variants, differ from *N. mitis* mainly in leaflet shape, for example *N. amboensis* has rhomboid leaflets (Figure 3a), while *N. brachypus* has oblique leaflets that are rounded at the base (Figure 3c), as opposed to ovate, oblong or rounded in *N. mitis*. *Neorautanenia mitis* is distinguishable from the only other species in the genus, *N. ficifolius*, by the silky-hairy leaflets that are either entire or tri-lobed (if the latter, then the ribs are not prominent), whereas they are roughly hairy and subvillous and always 3–5-lobed with prominent ribs in the *N. ficifolia*. The stipules of *N. mitis* are smaller than those of *N. ficifolia* (5–7 × 1–3 mm vs. 5–11 × 1–5 mm).

Additional specimens examined

BOTSWANA. —1923 (Maun): Mboma (–AA), 09 Feb. 1975, P.A. Smith 1239 (PRE); Moremi Game Reserve: Mboma Island, at top loop (–AB), 28 Dec. 1996, V. Roodt 303 (PRE). 2022 (Lake Ngambi): Ngamiland (–BA), Dec. 1930, H.H. Curson 263;



Km, kilometre.

FIGURE 2: Geographical distribution of *N. mitis* in southern Africa.



Source: https://plants.jstor.org/search?filter=name&so=ps_group_by_genus_species+asc&Query=neorautanenia

FIGURE 3: Type specimens of (a) *N. amboensis*; (b) *N. mitis*; (c) *N. brachypus*.

579 (PRE); 7.75 km from the crossroads N of Kgwebe where the Maun road meets (–DB), 26 Dec. 1977, P.A. Smith 2168 (PRE). **2121** (Ghanzi): Groot Laagte River (EAST), Fossil River valley (–AD), 15 Mar. 1980, P.A. Smith 3183 (PRE); Khutse Game Reserve (–DA), 22 Apr. 1979, L.C.C. Liebenberg 9005 (PRE). **2126** (Tlada Mabeli): Orapa, road towards S fence by farm (–AD), 22 Feb. 1975, A.M. Allen 306 (PRE); central Orapa BK 9 (1) (–BC), 10 Mar. 1999, P.A. Smith 5944 (PRE). **2221** (Okwa): 2 km along Okwa valley track W of Kang Ghanzi Rd (–BD), 29 Jan. 1979, A.R. Kreulen 549 (PRE). **2320** (Ukwi): 45 km NW of Nojane, along the road to Mamuno (–CC), 27 Jan. 1977, C. Skarpe S 121 (PRE). **2322** (Kang): 50 mi (80 km) N of Kang (–DD), 18 Feb. 1960, H. Wild 5075 (PRE). **2326** (Mahalapye): on road between Mahalapye and Lepheyhe (–BB), 13 Jan. 1958, J.S. de Beer 547 (PRE). **2421** (Tshane): Mabuasehube Game Reserve; Zonye Pan (–CA), 13 Mar. 1976, J. Vahrmeijer 3090 (PRE). **2425** (Gaborone): 14 mi (22.5 km) NW of Molepolole (–AB), 02 Dec. 1954, L.E.W. Codd 8926 (PRE); 10 mi (16 km) N of turn off from Molepolole-Letlhakeng road towards Ngware (–AB), 30 Dec. 1977, O.J. Hansen 3322 (PRE); 272 mi (437.7 km) NW of Molepolole (–AC), 25 June 1955, R. Story 4982 (PRE). **2426** (Mochudi): Mochudi (–BB), Jan. 1914, F.A. Rogers 6664 (PRE). **2520** (Mata Mata): Kalahari Gemsbok National Park, Swartpan (–AA), Feb. 1978, P.T. van der Walt 5741 (PRE).

NAMIBIA. —**1720** (Sambid): Okavango Native Terrain; 3 mi (4.8 km) E of Masare camp (–CC), 05 Jan. 1956, B. De Winter 4091 (PRE). **1723** (Singalamwe): 45 mi (72 km) from Katima Mulilo on road (Finaughtys) to Singalamwe (–CB), 30 Dec. 1958, D.J.B. Killick 3195 (PRE). **1724** (Katima Mulilo): Katima Mulilo dist; Gumkwe (–AD), 17 Feb. 1971, C.J. Geldenhuys 190 (PRE). **1813** (Ohopoho): 37 km N of Ohopoho (–DA), 12 Apr. 1966, J.W.H. Giess 9275 (PRE). **1815** (Okahakana):

Etosha National Park (–BC), 09 Apr. 1974, O.H. Volk 804 (PRE). **1817** (Tsintsabis): Etoshapan, along Onguma boundary (–CA), 13 Jan. 1971, Le Roux 288 (PRE). **1820** (Tarikora): 10 mi (16 km) N of Tamsu on road to Kapupahedi (–DA), 17 Feb. 1956, B. De Winter 4716 (PRE). **1914** (Kamanjab): 22.7 mi (36.6 km) NNW of Kamanjab (–BC), 07 Apr. 1955, B. De Winter 3101 (PRE); Hazeldene farm; Karos block (–DB), 18 Mar. 1957, B. De Winter 5109 (PRE). **1917** (Tsumeb): North of Kombat between Gauss and Gaup farms (–DA), 02 Mar. 1995, P.M. Burgoyne 3046 (PRE); Otavi (–CB), 06 Jan. 1925, M.K. Dinter 535 (PRE). **1918** (Grootfontein): road to Karakuwile, near Nurugas (–BD), 17 Dec. 1952, B. Maguire 2061 (PRE); Omatako, Omuramba (–DB), 19 Jan. 1994, P. Horn 173 (PRE). **1920** (Tsumkwe): On road to Tsumkwe, 50 km NE of Grootfontein (–AC), 07 Mar. 1995, G. Germishuizen 7637 (PRE); 7 km West of Gam-Nama Pan Road on Hereroland-Bushmanland border outline (–DC), 20 Dec. 1984, C.J.H. Hines 170 (PRE); 6 km E of Tsumkwe direction of Botswana border (–DA), 13 Jan. 1971, J.H.W. Giess 11018 (PRE). **2014** (Welwitschia): 26 km S of Khorixas (–BD), 25 Feb. 1990, D.S. Hardy 7055 (PRE). **2015** (Otjihorongo): Gross Tutara OU 55 (–AB), 28 Mar. 1965, J.W.H. Giess 8520 (PRE). **2016** (Otjiwarongo): Otjiwarongo District (–BC), May 1949, L.C.C. Liebenberg 4858 (PRE); road from Kalkfeld to Otjiwarongo, about 20 km NE Kalkfeld (–CA), 31 Dec. 1961, H.D. Ihlenfeldt 1962 (PRE); north of Outjo, hill slope (–CB), 12 Mar. 1997, G. Germishuizen 9738 (PRE). **2017** (Waterberg): Okamiparara (–AD), Jan. 1937, J. Boss TRV 36473 (PRE). **2115** (Karibib): Omaruru, Goedeheop OM 157 (–BD), 15 Feb. 1966, J.W.H. Giess 9182 (PRE). **2116** (Okahandja): Okahandja (–DD), 10 Jan. 1928, R.D. Bradfield 57 (PRE). **2117** (Otjosondou): Osire (–AB), 02 Feb. 1930, R.D. Bradfield 57A (PRE). **2118** (Steinhausen): Aurora farm; 37 mi (59.5 km) WSW of Steinhausen (–DC), 20 Feb. 1955, B. De Winter 2426 (PRE). **2215** (Trekopje): Gaub (–CB), 09 Jan. 1926, J.M. Borle 40 (PRE).

2216 (Otjimbingwe): Okomitundu (–AB), 19 Jan. 1958, *R.H.W. Seydel* 1328 (PRE); Khomas-Hochland; Otjiseva WIN 45 (–BD), 03 Mar. 1965, *J.W.H. Giess* 8410A (PRE). **2217** (Windhoek): Otjihundu win 208 FA (–BD), 02 Mar. 1973, *J.W.H. Giess* 12460 (PRE). **2218** (Gobabis): Witvlei townlands (–AD), 24 Apr. 1969, *M.H. Mason* 2591 (PRE); Sturmfeld farm (–BD), 19 Jan. 1961, *H.R. Tolken* 25 (PRE); 40 mi (64 km) N of Gobabis (–CB), Jan. 1957, *P.A. Basson* 243 (PRE). **2317** (Rehoboth): Eselmaanhaar (–BA), 26 Mar. 1949, *R.G. Strey* 2511 (PRE).

SOUTH AFRICA. LIMPOPO. — **2228** (Maasstroom): Tolwe, 100–105 mi (160–169 km) WNW of Mokopane (–DC), 24 Dec. 1951, *B. Maguire* 1287 (PRE); Tolwe, Calmar Ranch; Calmar Farm (–BA), 04 Mar. 2004, *H.M. Steyn* 500 (PRE). **2229** (Waterpoort): Dongola Reserve, Hackthorne farm 608 (–BC), 29 Apr. 1948, *L.E.W. Codd* 4145 (PRE); Langjan Nature Reserve (–CC), 24 Mar. 2003, *M. Jordaan* 4079 (PRE); Zoutpan; 3 mi (4.8 km) W of pan (–CD), 15 Apr. 1934, *H.G.W.J. Schweickerdt* 645 (PRE); Soutpansberg District, Witlaagte farm about 2 mi (3.213 km) N of the salt pan (–CD), 11 Feb. 1960, *L.E.W. Codd* 10002 (PRE). 90.6 km from Alldays on road to Graafwater (–DA), 30 Nov. 1998, *P.M. Burgoyne* 7167 (PRE). **2231** (Pafuri): Kruger National Park, Nwashitumbe; Voorbrand pad (–CC), 07 Jan. 1960, *A.M. Brynard* 4383 (PRE); SE of Punda Milia, Wambia sand pan (–CA), 31 Jan. 1962, *H-J.E. Schlieben* 9309 (PRE); Kruger National Park, Punda Milia, 9.5 mi (15.2 km) SE of Punda Maria (–CA), 14 Mar. 1949, *L.E.W. Codd* 5294 (PRE); Kloppefontein (–CA), 20 Mar. 1979, *N. Grobbelaar* 2352 (PRE). **2327** (Ellisras): Matlabas River; 5 mi (8 km) S of Limpopo (–CC), 14 Jan. 1955, *A.O.D. Mogg* 24585 (PRE). **2328** (Baltimore): Lugardi, Swerwerskraal (–DD), 23 Feb. 1936, *L.F. Irvine* 66 (PRE); Swartwater, Farm Doornkraal LR 015, second transect (–AA), 05 Feb. 2004, *P.N. Sebothoma* 496 (PRE). **2329** (Polokwane): Polokwane (–CD), 14 Nov. 1945, *J. Gerstner* 5621 (PRE). **2330** (Tzaneen): Middle Letaba Dam (–AD), 12 Apr. 1988, *S. Venter* 12,939 (PRE); Tzaneen (–CB), Jan. 1915, *H.G. Breijer TRV* 15615 (PRE); 8 km from Gravelotte towards Tzaneen 0.5 km before Rubbervale turnoff (–DC), 19 Apr. 1978, *P.R. Kruger* 297 (PRE). **2426** (Mochudi): at junction of Marico and Crocodile Rivers (–BB), 31 Jan. 1936, *J.W. Rowland* PRE20385 (PRE). **2428** (Nylstroom): Warmbaths; past reserve station (–CD), 06 Jan. 1945, *J.M. Murray* PRE 53207 (PRE); Naboomspruit; Springbok flats on Vogelstruispan farm (–DA), date not provided, *E.E. Galpin* 14664 (PRE); Naboomspruit; Geluk (–DA), 10 Jan. 1924, *E.E. Galpin* 583 (PRE); Crecy station (–DB), 30 Dec. 1935, *E.E. Galpin* 13987 (PRE).

MPUMALANGA. — **2430** (Pilgrim's rest): Hoedspruit District, Suikerkop farm (–BD), 16 Nov. 1973, *N. Zambatis* 549 (PRE); Kruger National Park, Vlakteplaas Ranger Section; 0.5 km east of tar road, on road from Babalala picnic site to Shingomeni (–CD), 15 Jan. 1994, *N. Zambatis* 1952 (PRE). **2531** (Komatipoort): Kruger National Park; halfweg tussen Lower Sabie en Krokodilbrug (–BB), 17 Jan. 1953, *H.P. van der Schijff* 1753 (PRE); 1 km from Malelane towards Kaap Muiden (–CB), 11 June 1975, *E.J. Van Jaarsveld* 531 (PRE).

GAUTENG. — **2528** (Pretoria): Pretoria University (–CA), 07 Dec. 1935, *E. Wyers* PRE 53223 (PRE).

Localities unspecified:

Narugas District, 20 Dec. 1934, *E.B.W. Schoenfelder* 973 (PRE).

Otjinene District, low Omuramba, 11 May 2001, *M.M. Uiras* MU340 (PRE).

Between Sherwood ranch and Martins drift, 12 Mar. 1977, *O.J. Hansen* 3072 (PRE).

Deception Valley; Central Kalahari Game Reserve at the edge of Fossil Valley, 16 Dec. 1984, *D.T. Williamson* 195 (PRE); Deception Valley, 11 May 1986, *S.E. Chadwick* 232 (PRE). Gemsbok Nature Reserve, Nov. 1967, *J. Tanaka* 56 (PRE); Serobe, borehole, 12 Feb. 1987, *I.J. Barnard* 262 (PRE); Xanakuna-Moshu road, 11 Dec. 1974, *P.A. Smith* 1223 (PRE).

2. *N. ficifolius* (Benth.) C.A.Smith in Burt Davy, Flowering Pl, Ferns Transvaal 2: xxvii & 417 (1932). *Rhynchosia ficifolia* Benth. in Harv. & Sond., Fl. Cap. 2: 251 (1862). *Dolichos ficifolius* (Benth.) Harms in Veg. Erde (Engler) 9(3,1): 681 in obs. 1915 [Pflanzenw. Afr.]. *Pueraria ficifolia* (Benth.) L.Bolus in Ann. Bolus Herb. 1: 189 (1915). Type: South Africa, North West, 'Magaliesberg', *Burke s.n.* Herb. Hook. (K, lecto.!, designated here, see taxonomic note). Other original material: *Zeyher* 519 (BM, isolecto.!, designated here).

Neorautanenien deserticola C.A.Smith, 1.c. xxvii & 417 (1932). Type: South Africa, North West, 'Hobson's farm', 25 Apr. 1924, *Henrici* 134 (PRE, holo.!).

Sub-erect, scrambling or occasionally prostrate perennial herb up to ca. 1.5 m long, growing from a large underground tuber, above-ground parts roughly hairy and subvillous. Leaflets rhombic-obovate to almost round, 3-lobed, with prominent ribs and veins beneath, mucronate, 6–12 × 3–6 mm, the central lobe narrowly oblong to ovate, lateral lobes somewhat asymmetric, acute, coriaceous. Petiole 15–60 mm long, terminal leaflet petiolule (5)20–30 mm long; stipules narrowly oblong-lanceolate, 5–11 × 1–5 mm; stipels 4–9 mm long. Inflorescences (90)130–290 mm long, flowers 7–14 mm long. *Calyx* densely villous, tube 2–3 mm long; upper lobes 4–5 mm long, carinal lobes 6–7 mm long, lateral lobes 5–7 mm long. Standard obovate, 8–12 × 7–10 mm, glabrous, claw 1–3 mm long; wings obovate, sculptured, 7–12 × 2–3 mm, claw 2–4 mm long; keel slightly narrower than to the wings, 8–11 × 4–5 mm, claw 3–4 mm long. Gynoecium 5–7 × 0.5–1.0 mm. Pods oblong-cylindric, 40–100 × 14–20 mm, 2–3-seeded; seeds oblong-reniform, compressed, 8.6–11 × 4.0–5.5 mm (Figure 4). *Flowering time*: November–March.

Distribution and ecology: *Neorautanenien ficifolia* occurs in wooded grassland. It is distributed in Namibia, Botswana and South Africa (Limpopo, North West, Gauteng, Mpumalanga and Free State provinces) (Figure 5).

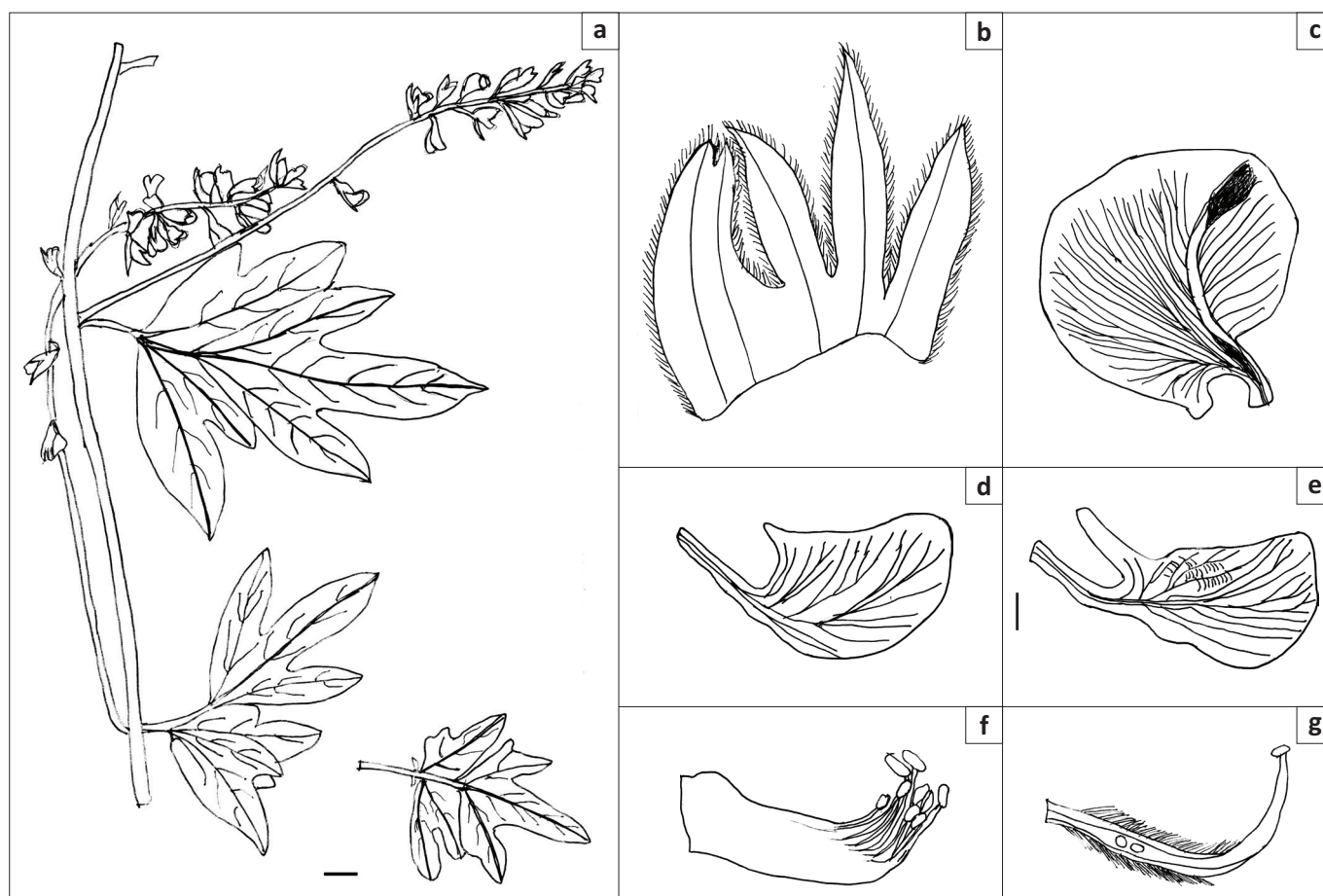


FIGURE 4: Vegetative and floral morphology of *N. ficifolius*. (a) Flowering branch; (b) calyx opened out with upper lobes to the left; (c) standard petal; (d) keel petal; (e) wing petals; (f) stamens; (g) pistil. Scale bars: (a) 10 mm; (b–g) 2 mm. Vouchers: (a1) *R. Story* 1479 (PRE); (a2) *O. J. Hansen* 3030 (PRE); (b–g) *Leendertz* 83 (PRE).

Taxonomic note

Although Bentham cited *Zeyher* 520 (519 in *Herb. Sond.*) in the description, Burke's specimen in K is chosen because it has locality details; in addition, because Burke and Zeyher often collected together, it is likely that the specimens are from the same collection.

Diagnostic characters

Neorautanenia ficifolia can be separated from *N. mitis* in leaflet morphology. Those of *N. ficifolia* tend to be coriaceous and are always lobed (3–5-lobed), with prominent ribs and veins on the lower surface, while in *N. mitis* they are silky-hairy and either entire or 3-lobed (sometimes 5-lobed, in which case the ribs are not prominent). Furthermore, the stipules of *N. ficifolia* are larger than those of *N. mitis* (5–11 × 1–5 mm as opposed to 5–7 × 1–3 mm).

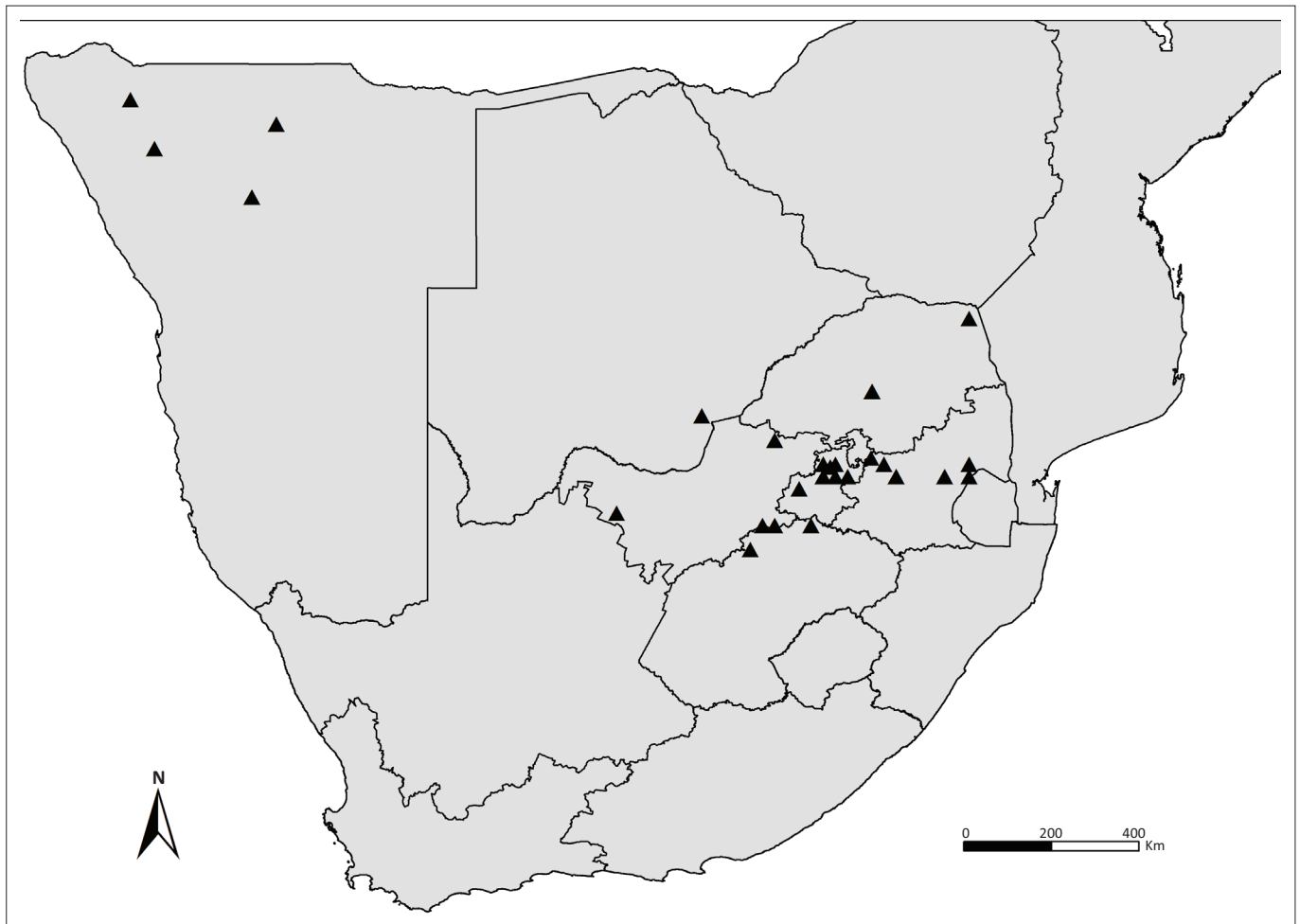
Additional specimens examined

BOTSWANA. —**2425** (Kwena District): 26 mi (41.8 km) W Van Thamaga (–DA), 06 May 1955, *J. L. Reyneke* 379 (PRE). **2524** Morapedi Ranch, 05 Feb. 1977, *O. J. Hansen* 3030 (PRE).

NAMIBIA. —**1813** (Ohopoho): Ondore (–BB), 1957, *Abner* 59 (PRE). **1914** (Otjosondou): 13 mi [20.92 km] N Otjikwara (–AB),

25 Jan. 1958, *H. Merxmüller* 1352 (PRE). **1917** (Tsumeb): 43 km from Otavi on road to Outjo (–CB), 09 Mar. 1995, *G. Germishuizen* 7786 (PRE); 18 km vanaf Tsumeb op pad na Otavi (–DB), 09 Feb. 1974, *N. Grobbelaar* 1903 (PRE). **2016** (Otjiwarongo): Otjiwarongo District, Gamgarab Farm, OU 176 (–AB), 30 Mar. 1965, *J.W.H. Giess* 8597 (PRE).

SOUTH AFRICA. LIMPOPO. —**2231** (Pafuri): Punda Milia (–CA), 26 Nov. 1932, *H. Lang* TRV 31078 (PRE). **2429** (Zebediela): Mokopane (–AA), 1909, *V.G. Crawley* TRV 13904 (PRE); 28 Sept. 1908, *R. Leendertz* TRV 5566 (PRE). **NORTHWEST.** **2527** (Rustenburg): on Buffelskloof farm in kloof on mt. side (–AA), 29 Nov. 1977, *G. Germishuizen* 530 (PRE); Uitkomst (–DD), 15 Jan. 1970, *B.J. Coetzee* 145 (PRE). **2623** (Vryburg): Vryburg division, between Zwartfontein and Geluk (–DB), 05 May 1912, *J. Burt Davy* 14051 (PRE). **2626** (Klerksdorp): Renovaal, Samevloei van Rhenoster Rivier en Vaal Rivier (–DD), 07 May 1976, *D.J. Botha* 1530 (PRE). **2627** (Potchefstroom): Krugersdorp District, Isaac Stegmann Nature Reserve, Sterkfontein Caves and Zwartkrans 67 (–BA), 29 Jan. 1972, *A.O.D. Mogg* 35756 (PRE); Taaibosbult 13 (–CC), 06 Mar. 1948, *W.J. Louw* 1697 (PRE). **GAUTENG.** — **2528** (Pretoria): Fountains Valley: flats below Ashbury (–CA), 11 Nov. 1944, *J.E. Repton* PRE 53219 (PRE); 13 Dec. 1928, *J.E. Repton* 159 (PRE); 13 mi (20.9 km) from Pretoria on Delmas road (–CA), 26 Nov. 1946,



Km, kilometre.

FIGURE 5: Geographical distribution of *N. ficifolia* in southern Africa.

R. Story 1479 (PRE); Bryntirion: camp between government house and high commissioner's office (–CA), 14 Nov. 1926, *C.A. Smith* 3355 (PRE); Crocodile River (–CA), 17 Feb. 1906, *R. Leendertz* 712 (PRE); Wonderboom poort (–CA), Feb. 1912, *H.H. Tame* TRV 11346 (PRE); Bryntirion: camp adjoining government house (–CA), 14 Nov. 1926, *C.A. Smith* 3355 (PRE); Doornhoogte (–CA), Dec. 1935, *J.C. Smuts* 3455 (PRE); Montana veld east of Montana value centre, ca. 1 km W of N1 on Zambezi Drive (–CB), 08 Nov. 2003, *S.P. Bester* 4363 (PRE); Doornpoort (–CB), 04 Nov. 1916, *I.B. Pole-Evans* PRE 13250 (PRE); between Lyttelton and Irene at railway crossing (–CA), 15 Nov. 1925, *C.A. Smith* 1127 (PRE); 12 mi (19.3 km) SE of Pretoria on Delmas road (–CA), 06 Feb. 1951, *L.E.W. Codd* 6362 (PRE); Rietvlei Reserve Station, 12 mi (19.3 km), SE of Pretoria (–CA), 20 Nov. 1946, *L.E.W. Codd* 2184 (PRE); Rietvlei Reserve (–CA), Nov. 1946, *J.E. Repton* 3165 (PRE); Rietvlei (–CA), 02 Mar. 1961, *R.G. Strey* 3681 (PRE); Lyttelton, between Pretoria and Germiston (–CA), 19 Nov. 1963, *H.J.E. Schlieben* 9995 (PRE); Irene Station (–CC), 25 Feb. 1948, *B. De Winter* 270 (PRE); Nov. 1922, *I.B. Pole-Evans* PRE 53222 (PRE); 09 Jan. 1922, *I.B. Pole-Evans* PRE 53221 (PRE); 15 Nov. 1925, *C.A. Smith* 1103 (PRE); Dec. 1923, *J.C. Smuts* PRE 61989 (PRE); just before entering Irene on road from Pretoria (–CC), 08 Jan. 1963, *B. De Winter* 7822 (PRE); Delmas road 17.5 km

from Pretoria (–CD), 26 Oct. 1985, *B. Clarke* 1430 (PRE); Irene, Doornkloof (–CC), Dec. 1927, *J.C. Smuts* PRE 61988 (PRE); Irene, Doornkloof (–CC), Dec. 1923, *J.C. Smuts* PRE 61990 (PRE); 9.5 mi (15.3 km) W of Bronkhorstspuit (–DC), 11 Jan. 1953, *J.P.H. Acocks* 16602 (PRE). MPUMALANGA. – 529 (Witbank): Witbank, Renosterhoek (–BD), 07 Dec. 1968, *G.K. Theron* 2028 (PRE); Middelburg, Doornkop, SE van Eerstekamp (–CB), 22 Nov. 1968, *C.J. du Plessis* 1147 (PRE); Middelburg District, near Witbank station (–CC), 25 Dec. 1905, *D.F. Gilfillan* 301 (PRE); Fothergill's farm (–DC), 23 Mar. 1912, *J. Burt Davy* 13334 (PRE); Middelburg (–DC), Jan. 1945, *Muller* PRE 29222 (PRE). 2530 (Badplaas): Buffelspruit (–DC), 17 Apr. 1976, *D.J. Botha* 1427 (PRE). 2531 (Komatipoort): Rhenosterkop 15: 'Marondisha' at base of sloping rock face (–CA), 24 Nov. 1985, *J.J.H. Onderstall* 1272 (PRE); Barberton district, Traiter, on path to Hyslops Creek (–CA), no date, *G. Thorncroft* PRE 53220 (PRE); Barberton (–CC), Dec. 1916, *R. Pott-Leendertz* 5314 (PRE). FREE STATE. 2726 (Odendaalsrus): de Bank farm 4 mi (6.4 km) from Bothaville on Bothaville-Leeuwdoornstad (–BC), 15 Feb. 1963, *C. Brink* 1076 (PRE).

Localities unspecified:

Vaal River, Jan. 1830, *C.L.P. Zeyher* PRE 26838 (PRE).

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

A.M. conceptualised the study and edited the article. S.T. compiled the initial article and created the illustrations. T.S.M. did the initial sorting of herbarium specimens and compiled the distribution maps.

Ethical considerations

This article followed all ethical standards for research without direct contact with human or animal subjects.

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Data availability statement

Data sharing is not applicable to this article as no new data were created or analysed in this study.

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