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A revision of the genus *Bolusafra* (tribe Phaseoleae, Fabaceae)

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Abstract

A revision of the poorly known South African endemic genus *Bolusafra*, is presented. This monotypic genus is closely related to *Rhynchosia* and has not been revised since its description in 1891. The nomenclature and typification of the genus are given, together with distributional information. Illustrations of vegetative and reproductive characters, including the distinctive bulbous-based hairs and fleshy arils are provided.

Keywords: *Bolusafra*; Bulbous-based hairs; Taxonomic treatment; Uniseriate hairs; Vesicular glands

1. Introduction

Bolusafra Kuntze is a monotypic legume genus belonging to tribe Phaseoleae (Lackey, 1981). The initial genus name *Fagelia* Neck.; was rejected by resolution of the International Botanical Congress in 1959 (Bullock, 1965) on the basis that it is a later homonym of *Fagelia* Schwencke (Scrophulariaceae).

Within the tribe Phaseoleae, *Bolusafra* belongs to the distinctive subtribe Cajaninae Benth. It is the only subtribe with vesicular glands and bulbous-based hairs. The glands "consist of a squat head of cells contained within a shallow depression of the epidermis" (Lackey, 1981). Other characters of the subtribe include the absence of bracteoles (except in *Adenodolichos* Harms), absent or inconspicuous stipels and absence of a beard on the style (with the exception of *Adenodolichos*).

Bolusafra is a pleasantly scented perennial herb restricted to a small part of the Western Cape Province of South Africa. It is recognisable by its twining growth habit and viscidulous branches. Within the subtribe Cajaninae, it is very similar to *Rhynchosia* Lour., such that in Lackey's (1981) key it is described as a "viscid *Rhynchosia*-like vine". It however, differs from *Rhynchosia* in having prominent seed arils and turgid fruits. Chloroplast phylogeny of the tribe Phaseoleae (Doyle and Doyle, 1993) indicates that *Bolusafra* is close to, but not within *Rhynchosia*. Since its publication (Kuntze, 1891), the genus has received little attention. The aim of this paper is to revise the genus, to provide diagnostic features and illustrations of its morphology and to consolidate distribution records.

Key to the genera of the subtribe Cajaninae (adapted from Lackey, 1981):

1. Bracteoles present; style bearded above ***Adenodolichos***
1. Bracteoles absent, style not bearded:
2. Ovules 3 or more; arils often prominent:
3. Fruits turgid; viscid *Rhynchosia*-like vine — South Africa ***Bolusafra***
3. Fruits compressed:
4. Fruits not transversely grooved ***Dunbaria***
4. Fruits transversely grooved ***Cajanus***
2. Ovules 2 (–3); arils usually inconspicuous:
5. Calyx-lobes greatly expanded and papery after flowering ***Paracalyx***
5. Calyx-lobes not greatly expanded:
6. Leaves subdigitate or rarely 1-foliolate ***Flemingia***
6. Leaves pinnately compound or sometimes 1-foliolate:
7. Funicle of the seed attached in the middle of the hilum; hilum parallel to the fruit axis ***Rhynchosia***
7. Funicle of the seed attached at the end of the linear hilum; hilum obliquely transverse to the fruit axis ***Eriosema***

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1.1. Trichomes in Bolusafra

Three types of trichomes occur in *Bolusafra*: (1) uniseriate hairs with a short basal cell and a long, narrow terminal cell. This type occurs in many tribes including Dalbergieae, Galageae, Phaseoleae, Sophoreae (Metcalfe and Chalk, 1950) and members of the Genisteae (Moteetee et al., 2002). (2) vesicular glands; these are large glands with spherical heads and a few short basal cells, they are recorded in *Cajanus*, *Dunbaria*, *Eriosema*, *Flemingia*, *Rhynchosia* (Solereder, 1908; Metcalfe and Chalk, 1950) and now in *Bolusafra* (Fig. 1a and c). These glands occur on the stems, calyces, ovaries, fruits and on the lower surface of the leaflets. (3) bulbous-based hairs which are uni- or biseriate are recorded in *Adesmia*, *Eriosema*, *Fagelia*, *Ormocarpum* and *Rhynchosia* (Solereder, 1908; Metcalfe and Chalk, 1950) and now in *Bolusafra* (Fig. 1b and d). The bulbous-based hairs cover the whole plant.

1.2. Taxonomic treatment

Bolusafra Kuntze, Rev. Gen. 1: 162 (1891); Bullock in Kew Bull. 19(2): 200 (1965); R.A. Dyer, The genera of Southern African flowering plants: 271 (1975); Germishuizen in Leistner, Seed plants of southern Africa: 277–278 (2000); Lewis et al. Legumes of the World: 409 (2005). Type species: *B. bituminosa* (L.) Kuntze.

Glycine L. Sp. Pl.: 754 (1753), Syst. Veg. ed. 13: 1206 (1774), Syst. Nat. 2(2): 1106 (1792); Thunb., Fl. Cap.: 591 (1823), *pro parte minore*.

Fagelia Neck., Elem. 3: 41 (1790) *nom. nud.*, non Schwencke (1774); DC., Prodr. 2: 389 (1825); E. Mey., Comm.: 139 (1836); Harv., Fl. Cap. 2: 247 (1862); E. Phillips, The genera of South African flowering plants: 424 (1951); Hutch., The genera of flowering plants: 422 (1964). Type species: *F. bituminosa* (L.) DC.

DIAGNOSTIC CHARACTERS: *Bolusafra* has a growth habit similar to that of *Rhynchosia* from which it differs in having more ovules in each ovary (usually two in the latter), 6-seeded pods (2-seeded in *Rhynchosia*) and prominent arils. In addition, *Bolusafra* is distinguished from *Cajanus* and *Rhynchosia* by its turgid fruits (compressed in the latter two).

Bolusafra bituminosa (L.) Kuntze in Rev. Gen.: 162 (1891); Bullock in Kew Bull. 19(2): 200 (1965). Type: "*Phaseolus africanus hirsutus bituminosus*, *siliquis bullatis*, *flore flavo*" in Hermann, Hort. Lugd.-Bat. Cat., 492,493, 1687 [lectotype, designated by Schrire in Turland & Jarvis (eds.) in Taxon 46: 470 (1997)]. South Africa, Stellenbosch, Jonkershoek, 4 August

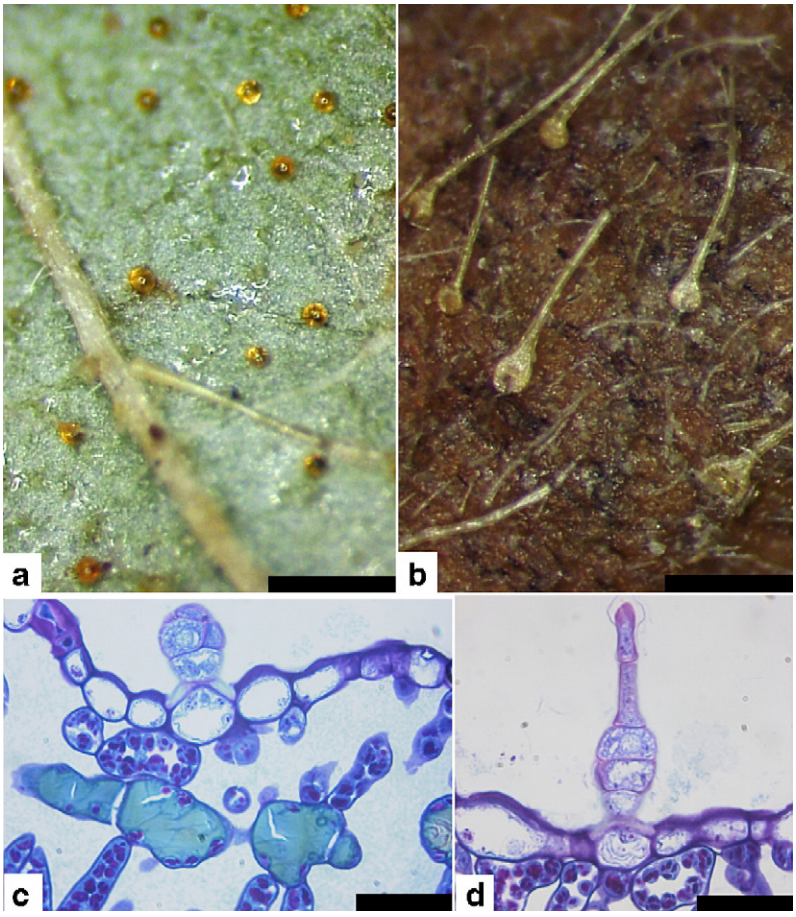

Fig. 1. Vestiture of *Bolusafra bituminosa*. a, glands on abaxial side of leaf; b, bulbous-based hairs on fruit; c, l/s of vesicular glands; d, l/s of bulbous-based hairs. [a from *R. Niemand 22* (JRAU); b–d from *B-E. van Wyk 2739* (JRAU)]. Scale bars: a, b, 0.7 mm; c, d, 0.9 mm.

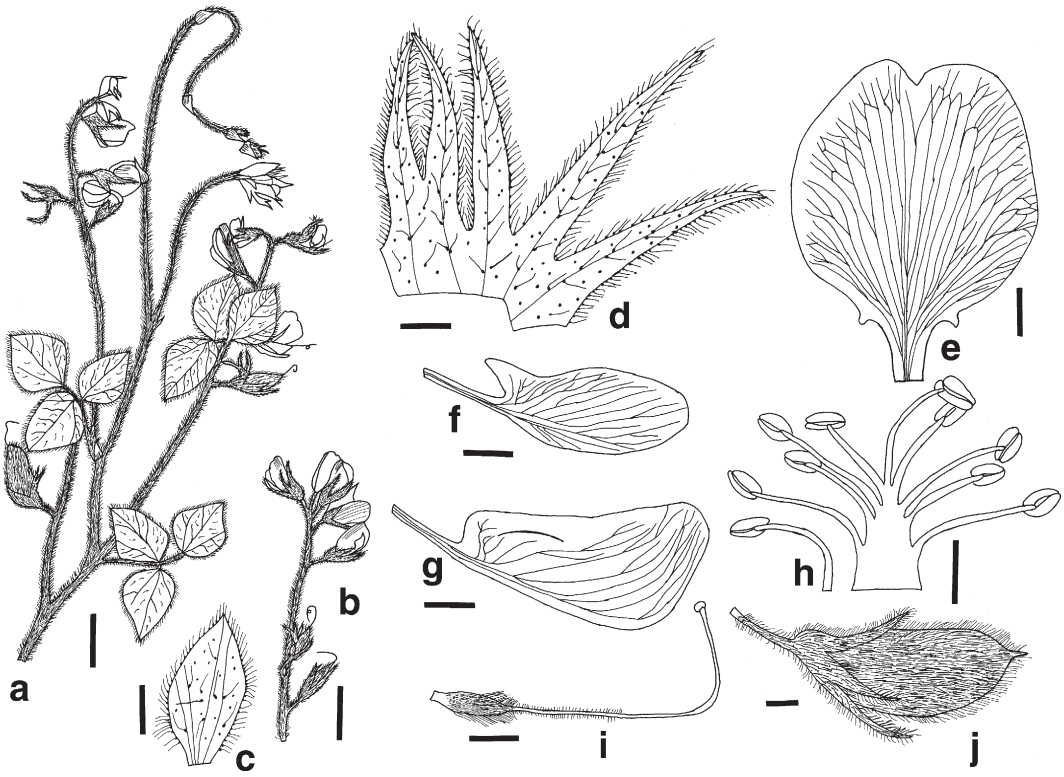

Fig. 2. Vegetative and reproductive morphology of *Bolusafra bituminosa*: a, flowering and fruiting branch; b, inflorescence; c, abaxial view of bract; d, calyx opened out with upper lobes to the left; e, standard petal; f, wing petal; g, keel petal; h, staminal sheath; i, ovary; j, fruit. [a, d–f and h from *R. Niemand 22* (JRAU); b, c, g, i and j from *B-E. van Wyk 2739* (JRAU)]. Scale bars: a, b, 7.5 mm; c–j, 2 mm.

1917, *S. Garside 1035* [K, epitype, designated by Schrire in Turland & Jarvis (eds.) in Taxon 46: 470 (1997)].

Glycine bituminosa L., Sp. Pl.: 754 (1753); Syst. Veg. ed. 13: 1206 (1774) & Syst. Nat. 2(2): 1106 (1792); Thunb., Fl. Cap.: 591 (1823). Type as above.

Fagelia bituminosa (L.) DC., Prodr. 2: 389 (1825); Eckl. & Zeyh., Enum. 2: 257 (1836); E. Mey., Comm.: 139 (1836); Harv., Fl. Cap. 2: 247 (1862). Type as above.

Fagelia flexuosa Meisn. in Hook., Lond. J. Bot. 2: 93 (1843), *nom. nud.*

Twining, evergreen perennial herbs up to 0.8 m high, covered with bulbous-based hairs, strongly scented. ***Leaves*** pinnately trifoliolate with conspicuous veins, stipulate; leaflets ovate, (15–) 18–43 × 9–38 mm, gland-dotted beneath, glabrescent above; petiole almost as long as the leaflets, (20–) 22–30 (–35) mm long; stipules ovate, (4–) 6–10 × (2–) 4–6 mm, striate. ***Inflorescence*** axillary, racemose, 80–150 mm long, 6–10-flowered. ***Bracts*** ovate, caducous, 8–12 × 3–5 mm; bracteoles absent. ***Calyx*** five-lobed, upper lobes 2, slightly connate, 12–15 mm long, lower lobes 13–18 mm long, almost as long as the corolla; covered with glands and bulbous-based hairs. ***Corolla*** yellow, standard obovate, reflexed, 13–20 × 12–18 mm, glabrous, base eared, claw broad, ±2 mm long; wing petals shorter than the keel petals, oblong, 9–14 × 6–7 mm, eared, claw narrow, linear, 4–5 mm long; keel petals obliquely obovate, 14–16 × 7–8 mm, apex dark purple, claw narrow, linear, 4–5 mm long. ***Stamens*** diadelphous, anthers uniform, filaments 2–4 mm long, sheath 8–15 mm long. ***Ovary*** sessile, 4–6 × 1–2 mm, gland-dotted, ovules 5–7, style filiform, 15–19 mm long, geniculate, hairy in lower portion, somewhat thickened and glabrous in upper portion, stigma terminal and

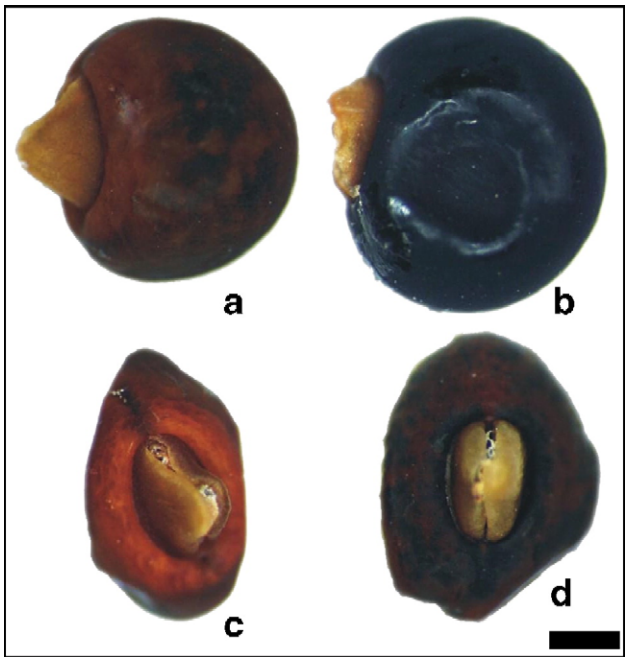

Fig. 3. Seeds of *Bolusafra bituminosa*: a and b, seeds in lateral view; c and d, seeds in hilar view showing fleshy arils. [a and c from *R. Niemand 22* (JRAU); b and d from *B-E. van Wyk 2739* (JRAU)]. Scale bars: a–d, 1 mm.

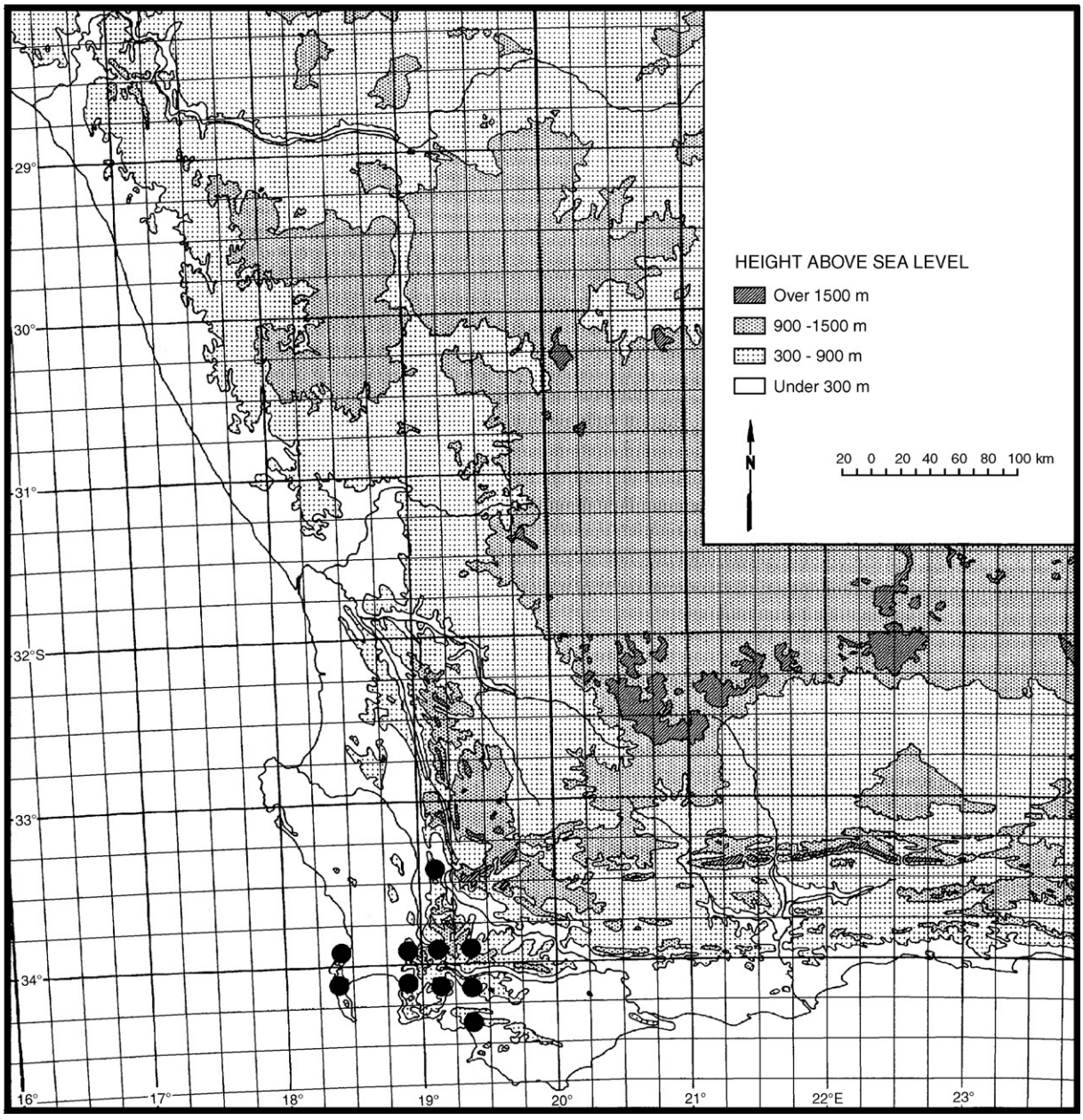

Fig. 4. The known distribution of *Bolusafra bituminosa*.

capitate. ***Fruit*** cylindrical, (15–) 16–20 (–30) × (4–) 5–10 mm, turgid, hirsute, gland-dotted, 4–6-seeded (Fig. 2). ***Seeds*** globose, 2–4 × 1–3 mm, dark brown to black; rim aril conspicuous, fleshy, interrupted at the micropylar and lens ends (Fig. 3), hilum large, oval, with median groove, hilum length parallel to the seed length.

1.3. Specimens examined

—**3318** (Cape Town): Claremont (–CD), *I. Verdoorn s.n.* sub PRE 55957 (PRE); Kirstenbosch, contour path between Window Stream and Skeleton Gorge (–CD), *B-E. van Wyk 2739* (JRAU), *R. Niemand 22* (JRAU); Skeleton Gorge (–CD), *R.J. Rodin 3222* (PRE), *G. Germishuizen 4080* (PRE); Cape Town (–CD), *E. Esterhuysen 26550* (BOL), *N. Grobbelaar 1216* (PRE), *Werdermann & Oberdieck 401* (PRE), *H.W.R. Marloth s.n.* (PRE), *F.M. Paterson 47 TVP, 25744* (PRE); Foot of Devil's Peak (–CD), *J.B. Thompson s.n.* sub PRE 55973 (PRE), *A.H. Wolley Dod 10592* (PRE); Devil's Peak (–CD), *A. H. Wolley Dod 11* (BOL); Camps Bay (–CD), *R.G. Strey 612* (PRE); Langrivier at Jonkershoek (–CD), *B-E. van Wyk 3139* (JRAU); Jonkershoek, Stellenbosch (–DD), *N. Grobbelaar 1175* (PRE); Jonkershoek State Forest, Helderberg, Compartment C1A (–DD), *D.M. Richardson 54* (PRE); Verlorenkloof, Stellenbosch (–DD), *H. Geertsema 2433b* (PRE); Bosboukloof (–DD), *O. Kerfoot 5786* (PRE), *A.E. de Kock 14* (PRE); Assegaaibosch Nature Reserve, next to foreman's house by the bridge, along the river (–DD), *N. Grobbelaar 2740* (PRE).

—**3319** (Worcester): Suendaal (Tygerskloof), Tulbagh (–AC), *Zeyher s.n*. sub SAM 15603 (SAM); Lower part of Franschhoek Pass (–CC), *J.A. Marsh* 656 NBG); Villiersdorp — road to Waterworks Dam on Elands River (–CD); *V. Osrin 19* (PRE).

—**3418** (Simonstown): Kalk Bay (–AB), *Zeyher s.n.* sub SAM 15602 (SAM); near Simonstown (–AB), *H. Bolus s.n.* sub PRE 55954 (PRE); Cape Town Silvermine, top of the pass (–AB), *B-E. van Wyk 3241* (JRAU), *C.H. Stirton 11209* (PRE); Chapman's Peak Drive (–AB), *C.H. Stirton 9967* (NBG, PRE); on the Steenberg (–AB), *N.S. Pillans 3110* (BOL, PRE); Muizenberg (–AB), *J. Hutchinson 309* (BOL, PRE); Fish Hoek (–AB), *G. van Niekerk 148* (BOL, PRE); Karbonkelberg (–AB), *C.H. Stirton 9075* (PRE); between Kommetjie and Scarborough, along the sea (–AB), *Grobbelaar 2051* (PRE); Mts. between Kommetjie and Glencairn (–AB), *A.S.L. Schelpe* (BOL); Kommetjie (–AB), *S. Schus s.n.* sub BOL 124982 (BOL); Noordhoek (–AB), *E. Wasserfall 668* (NBG); Mountains north of Sir Lowry's Pass (–BB), *J. Hutchinson 350* (PRE); Somerset West, moist ravines (–BB), *R.N. Parker 3882* (BOL, NBG); S side of Hout Bay (–BB), *J.B. Gillett 415* (NBG).

—**3419** (Caledon): Palmiet River Valley (–AA), *J.P. Stoeke s.n.* sub SAM 66047 (SAM); Zwartberg and the vicinity of the baths (–AB), *C.L.P. Zeyher 2411* (PRE, SAM); Salmonsdam Nature Reserve, Stanford (–AD), *L. Hugo 2630* (NBG).

DISTRIBUTION AND HABITAT: *Bolusafra* is restricted to the Cape Peninsula and the mountains of the Western Cape Province, from Tulbagh in the north to the Caledon region in the south (Fig. 4). It grows in moist river beds, open shrubland and on rocky slopes in loamy soil or sandstone-derived gravel.

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